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AN INTERACTIVE COMPUTER PROGRAM FOR SUBJECTIVE SYSTEMS AND ITS APPLICATION

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PREFACE

The utility approach to multiobjective decision problems has recently attracted increasing attention in various fields, especially in systems analysis. Multiobjective decision problems have two difficulties. The objectives are usually in conflict with each other, and they are noncommensurable, that is they can not be measured in a common unit such as a monetary term. Thus our problem is to construct a comprehensive standard for systems management, planning and evaluation with rational procedures.

The multiattribute utility function (MUF) method is one of the most effective devices for evaluating multiobjective decision problems under uncertainty. A computer program for the MUF method has been developed using PL/1 language and published as IIASA Research Memorandum in 1975. This program (MUFCAP) is based on interactive utilization of time-sharing computer systems. In this paper the original program is largely revised. The revised program is written in FORTRAN language. This new package is called ICOPSS/I.

The System and Decision Sciences area of IIASA has been promoting multiobjective decision analysis, especially in Task 1: Decision and Planning Theory. This paper is especially related to the subtask on Decision Processes and Hierarchical Structure and intends to provide a modest contribution to such a direction for decision sciences. Dr. M. Sakawa was invited to IIASA to complete this work in cooperation with Dr. F. Seo. The computer package was run on computer facilities at Kobe University. The authors are indebted to Dr. Hiroyasu Takahashi, Tokyo Scientific Center of IBM Japan, for his excellent contributions to convert the original MUFCAP programs to FORTRAN language at an early stage of this work. The authors would also like to thank Mr. Sumio Hasegawa of Kobe University for his cooperation in this study. Some results of this paper were presented at the Fifth European Meeting on Cybernetics and Systems Research, Vienna, April 8-11, 1980.

ABSTRACT

Decision problems have two phases: analytical and judgmental. In the judgmental phase of decision processes, preference order for alternative policy plans must be articulated with procedures for coordination and integration of various aspects for subproblems. For this purpose, decision analysis under uncertainty plays an essential role.

In this paper we intend to develop a quantitative analysis of hierarchical preference structures for aiding decisions. An interactive computer program for subjective systems is presented and applied for assessing recent industrial development in the Sensyu area of Japan. Alternative policy plans are examined and evaluated.

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M. Sakawa, and F. Seo

1. INTRODUCTION

Decision analysis for aiding selections of priorities among alternative policy-design has been well-developed since the mid-1960's. Based on rationality of human behavior and consistency of preference ordering in a normative sense, well-defined utility function concepts have been established and utilized as criterion functions in the decision-making processes. Raiffa (1968), Schlaifer (1969), Fishburn (1965, 1971, etc.) and Keeney (1976) have made a great contribution to this field.

A main characteristic of decision analysis is in interactive processes for making decisions or selecting priorities among alternative policies. Thus, decisionmaking processes proceed iteratively and sequentially. Repetitive computation procedures make up the major part of assessment and calculation of the criterion functions. Calculation processes include assessment of single or component utility functions and various types of probability distribution functions, evaluation of expected utility functions, calculation of multiattribute utility functions with alternative weighting constants and sensitivity analysis. Indifference experiments for deriving multiattribute utility functions are also essential. Assessors must know promptly about alternative results calculated with alternative parameters and proceed to the next stage sequentially. To compare the final results of numerical evaluation for alternative plans is especially important. Thus, mitigation and speed-up of computation works are indispensable to this approach, and interactive utilization of computer facilities are highly recommended.

Computer programs for assessing and calculating the single-attribute utility functions as well as probability distribution functions have been developed by Schlaifer (1971). These computer programs have been written in FORTRAN and called the MANECON collection. The MANECON collection has many eminent characteristics for assessing the various types of component utility functions and probability distribution functions. In particular, the collection has interactive characteristics which assist the decision maker in checking the consistency of his assessments. However, these programs have been developed only for single-attribute utility functions.

In 1975, Sicherman developed new computer programs for assessing and calculating multiattribute utility functions based on the representation theorems of Keeney (1974) and Keeney and Raiffa (1976). These programs were written in PL/I and called MUFCAP (multiattribute utility function calculation and assessment package). MUFCAP was designed to facilitate the assessment and calculation of a decision maker's utility function for multiple objectives in a hierarchical, multilevel system of preference structure.

Despite this progress, MUFCAP still has some shortage for assessing decision problems under uncertainty because of lacking calculation techniques for probability distribution functions.

Thus, the MANECON programs, which have more eminent characteristics for assessing the various types of probability distribution functions and the decreasing risk-aversion type of the single-attribute utility functions, must be combined with the MUFCAP program for assessing the multiattribute utility functions. Both devices must be called out efficiently with an integrated main program package.

This revised computer package is quite new and independently proposed with its originality. We call this ICOPSS/I (Interactive Computer Program for Subjective Systems). ICOPSS/I is written in FORTRAN. With this device, the accessibility of the package has been greatly enhanced because FORTRAN language is popular among many scientists and also smaller computer facilities are available for loading the program packages. This new package includes graphical representations by which assessors can figure the shapes of their utility functions, probability distributions, and indifference curves. Thus assessors can find incorrect assessments or inconsistent evaluations promptly, revise them immediately, and proceed to the next stage more easily.

An application with this computer program ICOPSS/I is presented and its effective operation is demonstrated in illustrations.

2. METHODOLOGY

2.1 Representation of the Utility Functions

In general, a multicriterion optimization problem is considered in the following form:

$$\underset{x \in X}{\text{Maximize}} \; \{f_1(x), f_2(x), \ldots, f_m(x)\} \tag{1}$$

where $f_i, i=1,\ldots,m$, is a criterion function (or objective function) of an n-dimensional decision vector x. x is a constrained set of feasible decision.

In problem (1), m objective functions are usually noncommensurate and in conflict with each other.

Now, consider this overall optimization problem (1) in the decomposed form:

$$\underset{x_i \in X}{\text{Maximize}} \; \{f_1(x_1), f_2(x_2), \ldots, f_m(x_m)\} \tag{2}$$

where x_i is an n_i dimensional decision vector in a subsystem i, $i = 1,2,\ldots,m$.

To manipulate the noncommensurateness and conflict in problem (2) consider an overall decision problem (3) in the following form:

$$\underset{x_i \in X}{\text{Maximize}}\ U\{f_1(x_1), f_2(x_2), \ldots, f_m(x_m)\} \quad . \tag{3}$$

Function U in problem (3) is an overall preference function defined on all the values of the multidimensional criteria function $\{f_i(x_i)\}$. It is called *the multiattribute utility function.* Measures of effectiveness of each criterion function $f_i(x_i)$ are called *attributes.* f_i and x_i can also be multiattribute utility functions or single-attribute utility functions. In this case, the procedure of sequentially embedding component utility functions to form the composite utility function is called *nesting* and the overall preference function U expresses a preference hierarchy in the following form ($q < m$):

$$\underset{x_i \in X}{\text{Max}}\ U[u^1(x^1), u^2(x^2), \ldots, u^q(x^q)] \tag{4}$$

$$= \underset{x_i \in X}{\text{Max}}\ U[u^1(u_1(x_1^1), u_2(x_2^1), \ldots, u_q(x_q^1)), u^2(u_{q+1}(x_{q+1}^2), \ldots, u_r(x_r^2)), \ldots, u^q(u_{s+1}(x_{s+1}^q), \ldots, u_m(x_m^q))] \quad , \tag{5}$$

where x^j is a vector whose component is x_i^j. x_i^j can also be a vector. $u_i(x_i^j)$ is a conventional component utility function when x_i^j is a scalar. Expression (5) shows the nesting of m subsystems into q subsystems where u_i can also be a multiattribute utility function. The nesting procedures can be executed one after another in the objectives hierarchy of the stratified systems.

Now the problem is to specify a function form of formulation (3). Along the lines of Keeney and Raiffa (1976), define the preferential independence and utility independence as follows. (From now on, X_i will be used instead of $f_i(x_i)$ in (3) to represent an attribute. A level of the attribute X_i is shown by x_i.)

<u>Definition 1</u>. (Preferential independence)

Any pair of two attributes (X_i, X_j) is preferentially independent of the other attributes $X_{\overline{ij}}$ if one's preference order for consequences (x_i, x_j) with the other attributes $x_{\overline{ij}}$ held fixed does not depend on the fixed amount of $x_{\overline{ij}}$. Namely, trade-offs under certainty between various amounts of two attributes, x_i and x_j, do not depend on $x_{\overline{ij}}$.

<u>Definition 2</u>. (Utility independence)

Attribute X_j is utility-independent of the other attributes $X_{\bar{j}}$ if one's preference order over lotteries on X_j with $x_{\bar{j}}$ held fixed does not depend on the fixed amount of $x_{\bar{j}}$.

It should be noted that, whereas preferential independence only concerns preferences for sure consequences, utility independence concerns preferences for lotteries on consequences with probabilities of occurrence. From these definitions, the representation theorem of the multiattribute utility function is derived as follows.

<u>Theorem 1</u>. Given $X_1, X_2, \ldots, X_m$, $m \geq 3$, suppose for some X_i that both $\{X_i, X_j\}$ is preferentially independent for all $j \neq i$, and X_i is utility independent, then either the additive utility function:

$$U(x_1, x_2, \ldots, x_m) = \sum_{i=1}^{m} k_i u_i(x_i) \quad , \quad \text{if } \sum k_i = 1 \quad , \qquad \ldots(6)$$

or the multiplicative utility function:

$$1 + KU(x_1, x_2, \ldots, x_m) = \prod_{i=1}^{m} (1 + Kk_i u_i(x_i)), \text{ if } \sum k_i \neq 1 \ldots(7)$$

where

i) U and u_i are utility functions scaled from 0 to 1,

ii) $0 < k_i < 1, \quad i = 1, 2, \ldots, m \quad ,$

and if $\sum_m k_i \neq 1$, $K > -1$ is the non-zero solution to

iii) $$1 + K = \prod_{i=1}^{m} (1 + Kk_i) \quad . \qquad \ldots(8)$$

Parameters k_i and K are called *scaling constants.*

2.2 Assessing the Single-Attribute Utility Functions

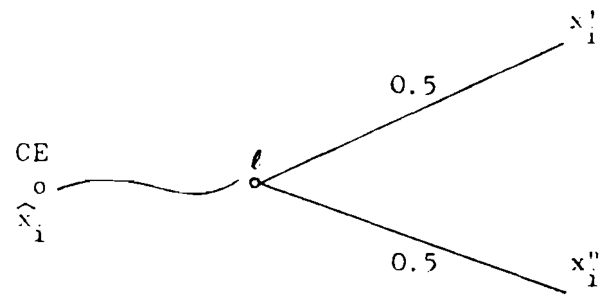
Before assessing the single-attribute utility functions, appropriateness of independence assumptions must be examined. Namely, in the selection of attributes, preferential independence and utility independence for each attribute should be checked.

In the cases where these independence conditions are not completely justified, grouping of the attributes into several classes, within which independence assumptions can be satisfied, is recommended. In other words, the nesting procedure can be used as a device for fulfilling the independence assumptions.

First, to test the preferential independence, fixing all the components of attributes $X_{\overline{ij}}$ at the worst level $x_{\overline{ij}0}$, find the assigned levels (x_i, x_j) of a pair of attributes (X_i, X_j) which are indifferent to other assigned levels of them (x_i', x_j'). Then changing the attributes to the best level $x_{\overline{ij}1}$, ask the decision maker if the levels of the pair (x_i, x_j) are still indifferent to the other levels of the pair (x_i', x_j'). If the preference order of the two attributes (X_i, X_j) is preferentially independent of $X_{\overline{ij}}$ the answer will be "yes".

Repeat the same procedure for the levels (x_i'', x_j'') of the attributes (X_i, X_j) indifferent to other levels (x_i''', x_j''') of them with $x_{\overline{ij}}$ fixed at various levels. If the same indifference holds for every choice of $x_{\overline{ij}}$, the pair of attributes (X_i, X_j) are preferentially independent of the other attributes $X_{\overline{ij}}$.

Then, to check utility independence, assess Certainty Equivalents (CE) $\hat{x}_i$ indifferent to a lottery ℓ yielding either x_i' or x_i'' with equal probability, holding $x_{\overline{i}}$ at a fixed level.



If the CE for any lottery does not depend on the amounts of $x_{\overline{i}}$, then x_i will be utility independent of $x_{\overline{i}}$. In practice, this experiment should be performed for three or four cases with various amounts of (x_i, x_j) and the $x_{\overline{i}}$.

The scale of the ranges of attributes can be subjective as well as objective. The subjective scale for an attribute such as social impact is suitable for considering many elements at once in terms of subjective judgments with a proper procedure.

In deriving the uniattribute utility functions (UNIF), a few points $(u_i(0), u_i(0.25), u_i(0.5), u_i(0.75), u_i(1))$ of UNIF are determined using the 50-50 chance lottery technique.

Let ℓ be a lottery with n chance forks yielding a consequence x_{is} with probability P_{is}. The expected value (EV) of utility of this lottery is $\sum_{s=1}^{n} P_{is} u_i(x_{is})$. An indifference experiment is performed to find the amount $\hat{x}_i$ for certain of an attribute indifferent to the expected utility of the lottery. Namely,

$$u_i(\hat{x}_i) = \sum_{s=1}^{n} P_{is} u_i(x_{is}) \quad . \qquad \ldots (9)$$

The amount $\hat{x}_i$ is called the certainty equivalent (CE). In the following the utility function $u_i(\hat{x}_i) = q$ will be written as $u_i(\hat{x}_{iq})$. A 50-50 chance lottery with two chance forks yields the worst level x_{i0} or the best level x_{i1} of an attribute X_i with a probability of 0.5 for each. The expected value of the utility of this lottery is 0.5. The CE of this lottery is an amount $\hat{x}_{i0.5}$ evaluated with the same value 0.5 as the EV of this lottery. The 50-50 chance lottery technique is used for finding other amounts of CE. Because $u_i(x_{i0}) = 0$, $u_i(x_{i1}) = 1$, by plotting these five points a utility curve is depicted.

In ICOPSS/I, hypothetical forms of single attribute utility functions are presumed to be (i) linear (ii) piecewise linear (iii) constant risk attitude (iv) decreasing risk averse and (v) increasing risk prone.

In the following, a brief explanation of these five types of utility functions is given.

In general, the risk function is

$$r_i(x_i) = -\frac{u_i''(x_i)}{u_i'(x_i)} = -\frac{d}{dx_i} \log u_i'(x_i) \quad .$$

If the utility function is linear, $u_i(x_i) = Ax_i + B$, then $r_i(x_i) = 0$, which represents risk neutral. For the utility functions with constant risk attitude, $u_i(x_i) = A - Be^{-cx_i}$, $r_i(x_i) = c$ (constant). When $c > 0$, $u_i(x_i)$ is a constant risk-averse. When $c < 0$, $u_i(x_i)$ is a constant risk-prone.

The utility functions with decreasing risk aversion are fitted in the following form.

$$u_i(x_i) = Ae^{-Bx_i} + Ce^{-Dx_i} + E \qquad (11)$$

$$B > 0 \quad , \qquad ACD > 0 \qquad (12)$$

The local risk aversion function is

$$r_i(x_i) = \frac{AB^2e^{-Bx_i} + CD^2e^{-Dx_i}}{ABe^{-Bx_i} + CDe^{-Dx_i}} \quad . \qquad (13)$$

The conditions $B > 0$ and $ACD > 0$ guarantee that the risk aversion function is decreasing over $[-\infty,\infty]$. In addition, if A, C and D are positive, the risk-aversion function (11) is everywhere positive; if $AC < 0$ (accordingly $D < 0$), the risk-aversion function is positive to the left side of

$$x^* = \frac{1}{B-D} \log \left(- \frac{AB^2}{CD^2}\right) \qquad (14)$$

and negative to the right side of x^* where $r_i(x^*) = 0$.

For utility functions with increasing risk proneness, similar discussions can be made.

2.3 Evaluating the Scaling Constants

For evaluating multiattribute utility functions (6) and (7), scaling constants k_i and K are assessed. For this purpose, the following three types of method are included in ICOPSS/I.

(1) Input k_i directly.

(2) Select one pair of indifferent points among attributes and a probability for a prescribed lottery, responding to the following questions.

Question 1. Select a level x_i' of an attribute X_i and a level x_j' of another attribute X_j, such that, for any fixed levels of all the other attributes $X_{\overline{ij}}$ you are indifferent between

i) a consequence yielding x_i' and x_{j0} together, and
ii) a consequence yielding x_j' and x_{i0} together.

Question 2. Consider a lottery such that all the attributes X take a best level x_1 with a probability p and a worst level x_0 with a probability 1 - p. For which probability p are you indifferent between

i) the lottery giving a chance p to x_1 and a chance 1 - p to x_0, and
ii) the certain consequence $(x_{j1}, x_{\overline{j}0})$

(3) Select the two pairs of indifferent points among any two attributes, responding to the following question:

Question 3. Select four points A, B, C, D among each pair of attributes X_i and X_j, such that

$$A[x_i', x_j'] \sim B[x_i'', x_j'']$$
$$C[x_i''', x_j'''] \sim D[x_i'''', x_j''''] \quad ,$$

taking X_j as a base.

In method (2), taking any attribute X_j as a base, indifference points between each pair of the attributes X_i and X_j are sought with all the levels of other attributes $X_{\overline{ij}}$ held fixed. The indifference points express the trade-offs which measure how much one is willing to give up attribute X_j to gain a specific amount of another attribute X_i.

Using Question 1, the two points of a pair of attributes X_i and X_j which are indifferent to each other are sought as follows:

$$\begin{pmatrix} x_i' & : ? \\ x_{j0} & : \text{worst} \end{pmatrix} \sim \begin{pmatrix} x_{i0} & : \text{worst} \\ x_j' & : ? \end{pmatrix} \qquad i = 1,\ldots,m,\ i \neq j \quad (15)$$

Utilities of the indifferent consequence can be equated to yield

$$k_i u_i(x_i') = k_j u_j(x_j') \qquad i = 1,\ldots,m \qquad i \neq j \tag{16}$$

$$\therefore \quad k_i = k_j u_j(x_j')/u_i(x_i') \quad . \tag{17}$$

In this way, the relative values of all the scaling constants $k_1,\ldots,k_m$ are expressed in terms of k_j.

The scaling constants k_j for the attribute X_j which has been taken as a base can be easily determined in answer to Question 2. If the p-value is determined as $\hat{p}$, the expected utility of the lottery is $\hat{p}$ and the utility of the certain consequence is k_j. Thus we find

$$k_j = \hat{p} \quad . \tag{18}$$

In method (3), taking attribute X_j as a base, two pairs of two indifferent points are assessed. In the additive case it is necessary to assess only one pair of two different values. In the following we assume the multiplicative form and show how to calculate k_i's and K from two pairs of indifferent points (A,B) and (C,D). For convenience, we use new notations $([x_i^A, x_j^A], [x_i^B, x_j^B])$, and $([x_i^C, x_j^C], [x_i^D, x_j^D])$ instead of $(A[x_i', x_j'], B[x_i'', x_j''])$, and $(C[x_i''', x_j'''], D[x_i'''', x_j''''])$.

Using the definition of the multiplicative utility function, utilities of indifferent points (A,B) and (C,D) are equated to each other. (Other attributes are fixed at the worst level.)

$$k_i(u_i(x_i^A) - u_i(x_i^B)) + k_j(u_j(x_j^A) - u_j(x_j^B))$$

$$+ k_i k_j K(u_i(x_i^A) u_j(x_j^A) - u_i(x_i^B) u_j(x_j^B)) = 0 \tag{19}$$

$$i = 1,\ldots,m, \qquad i \neq 0$$

$$k_i(u_i(x_i^C) - u_i(x_i^D)) + k_j(u_j(x_j^C) - u_j(x_j^D))$$

$$+ k_i k_j K(u_i(x_i^C) u_j(x_j^C) - u_i(x_i^D) u_j(x_j^D)) = 0 \tag{20}$$

$$i = 1,\ldots,m, \qquad i \neq 0$$

On the other hand, K is a non-zero scaling constant satisfying the equation

$$1 + K = \prod_{i=1}^{m} (1 + Kk_i) \quad . \tag{21}$$

From equations (19), (20) and (21), the k_i's and K values can be determined.

If

$$P \triangleq u_i(x_i^A)u_j(x_j^A) - u_i(x_i^B)u_j(x_j^B) \neq 0$$

and

$$Q \triangleq u_i(x_i^C)u_j(x_j^C) - u_i(x_i^P)u_j(x_j^P) \neq 0 \quad ,$$

equations (19) and (20) can be solved with respect to k_i/k_j and k_jK, and yield

$$k_i/k_j = -\frac{(u_i(x_i^A) - u_i(x_i^B))Q - (u_i(x_i^C) - u_i(x_i^D))P}{(u_j(x_j^A) - u_j(x_j^B))Q + (u_j(x_j^C) - u_j(x_j^D))P} \tag{22}$$

$$k_jK = \frac{(u_i(x_i^C) - u_i(x_i^D))(u_j(x_j^A) - u_j(x_j^B)) - (u_j(x_j^C) - u_j(x_j^D))(u_i(x_i^A) - u_i(x_i^B))}{(u_i(x_i^A) - u_i(x_i^B))Q - (u_i(x_i^C) - u_i(x_i^D))P} \tag{23}$$

where we assume both

$$R = (u_i(x_i^A) - u_i(x_i^B))Q - (u_i(x_i^C) - u_i(x_i^D))P \neq 0 \tag{24}$$

and

$$S = (u_j(x_j^A) - u_j(x_j^B))Q + (u_j(x_j^C) - u_j(x_j^D))P \neq 0 \ . \tag{25}$$

If R = 0 or S = 0, we can't determine k_i's from the input points (A,B), and (C,D). Equation (21) is rewritten as

$$1 + K = \pi(1 + (k_i/k_j)k_jK) \quad . \tag{26}$$

Substituting (22) and (23) into (26), the value of K can be determined. Substituting the value of K into (23), k_j is determined, and then also k_i $i = 1,\ldots,m$ $i \neq j$ can be determined from (22).

2.4 Performing Sensitivity Analysis

For examining how the estimated preference ranking would be changed if the input information differed from the current one, sensitivity analysis is performed at the vector $\left(\frac{\partial u}{\partial x_1}, \frac{\partial u}{\partial x_2}, \ldots, \frac{\partial u}{\partial x_n}\right)$ and the vector $\left(\frac{\partial u}{\partial u_1}, \frac{\partial u}{\partial u_2}, \ldots, \frac{\partial u}{\partial u_m}\right)$. Each component represents the the rate of change of u with respect to a change in the level of attribute x_j and utility u_i.

Sensitivity analysis performs the gradient calculations of the utility functions at each level in terms of the attributes and utility functions at the lower level.

3. THE COMPUTER PACKAGE

ICOPSS/I is composed of one main program and many subroutines. The main program calls in and runs the subprograms with commands indicated by the user. In the following, we briefly describe and explain major commands prepared in ICOPSS/I.

INPUT: Initiates a dialogue by indicating a name for an overall MUF structure, and requests the number and names of attributes which are included in MUF. A prompt "ANOTHER INPUT?" asks whether the input process should continue or not.

In the case of vector attributes or nested MUFs, the input process is executed continuously according to this procedure. Thus, a hierarchical structure of preference is specified in terms of utility functions with INPUT command. The input processes can be interrupted and the input data can be saved at any level of the MUF structure. This characteristic contributes to mitigate the trouble of putting in a large-scale data set at once.

SAVE: Saves all the information, which has been put in, in a file.

READ: Restores the information which was saved in the file.

STRUCT: Displays the MUF Structure along with the names of all attributes in a tree diagram by indicating the MUF name.

UNISET: Specifies any of five UNIF (uniattribute utility function) type by indicating the UNIF name. The UNISET command has an option for getting the list of UNIF types as follows.

(1) LINEAR
(2) PIECEWISE LINEAR
(3) CONSTANT RISK
(4) DECREASING RISK AVERSE
(5) INCREASING RISK PRONE

For each of those UNIF types, the following information inputs are required. For (1), the range of the attribute (worst or best). For (2), the range of the attribute and numerical values for the specified points in abscissa and ordinate. For (3), in addition to the range, specification of a CE (certainty equivalent) for a 50-50 chance lottery. This case is available both for constant risk averse and constant risk prone.

(4) and (5) have two options for data input as follows: (i) to input the five values of the attribute for which utility values are 0, 0.25, 0.5, 0.75, 1 or (ii) to input a range of the attribute and each CE for three 50-50 chance lotteries which can be arbitrarily chosen. If assessments for decreasing-risk-averse or increasing risk-prone-type utility functions are unsuccessful with the input data, a warning message prompts for inputting revised data. UNIF types (4) and (5) are newly included in ICOPSS/I and users can express their preference more accurately via interactive processes.

KSET: Specifies values of scaling constants for each MUF by indicating a name of a MUF. Three types of ways to calculate scaling constants are available:

(1) BY INPUT OF K'S VALUES DIRECTLY
(2) BY INDIFFERENCE PAIRS AND LOTTERY
(3) BY INDIFFERENCE PAIRS

For (1), the corresponding value of a scaling constant K for each MUF is calculated.

(2) is based on Questions 1 and 2 which have been described in Section 2.3.

Taking an attribute value x_j as a base, an indifference point to the x_j is input. With a p-value, all scaling constants k_i's for each UNIF and K are calculated.

(3) Requires inputting any two pairs of indifference points. In cases of nested MUFs, indifference experiments are executed in terms of utility values. Thus computer utilization is more effective in this respect. The KSET, INDIF1 and INDIF2 commands in the MUFCAP are unified in (3), and a function for consistency check is also included.

DEBUG: Lists characteristics of utility functions in any level of the MUF Structure. In the case of MUFs, names and scaling constants of all the attributes are listed. In the case of UNIFs, ranges of attributes, parameters and UNIF types (Type-1,...,Type-5) are listed.

ADDALT: Assigns a name for an alternative data set in which numerical values of all attributes included in a MUF Structure are specified. Four types of attribute variables are available and are used in mixture in the data set.

(1) CERTAINTY
(2) PROBABILITY: DISCRETE DISTRIBUTION
(3) PROBABILITY: CONTINUOUS DISTRIBUTION (PIECEWISE LINEAR)
(4) PROBABILITY: CONTINUOUS DISTRIBUTION (PIECEWISE QUADRATIC)

Types (2) and (4) are newly prepared in ICOPSS/I.

DROPALT: deletes the specified alternative data set from the data file.

EVAL: Evaluates numerical values of MUFs and UNIFs in an alternative data set.

GRAD: Calculates the gradient for a specified UNIF and MUF in terms of an attribute and a component utility function as follows:

$$\left(\frac{\partial u_1}{\partial x_1}, \frac{\partial u_2}{\partial x_2}, \ldots, \frac{\partial u_n}{\partial x_n}\right) \quad \text{and} \quad \left(\frac{\partial u}{\partial u_1}, \frac{\partial u}{\partial u_2}, \ldots, \frac{\partial u}{\partial u_m}\right)$$

DISPLAY: Displays characteristics of UNIFs and MUFs. For an UNIF, a range of attribute, parameters and type of UNIF are listed. For a MUF, the MUF Structure in a tree diagram and scaling constants are listed.

IMAP: Generates indifference points in a specified attribute (uname1-uname2) plane. A point through which the indifference curve will pass is requested. A value of one attribute (uname1) is input and then another attribute (uname2) value is required to maintain indifference.

GRAPHU: Depicts the shape of an UNIF graphically.

GRAPHI: Depicts graphically the shape of the indifference curve in a uname1-uname2 plane. A specified pair of indifference points through which the curve will pass is requested.

STOP: A word for gratitude to the operator is listed and the job ends.

4. APPLICATIONS

The ICOPSS/I is run for assessing and calculating the multi-attribute utility functions in the northern Sensyu area of the Osaka prefecture. The main aim of the assessment is to evaluate degrees of satisfaction for current situations of the industrial structure in this region.

The objective area is composed of the cities: Kishiwada, Kaizuka and Izumi. The three cities are located in the northern Sensyu area of the Osaka prefecture. In the southeastern part of these cities, there are the wide forest areas of the Izumi mountains of which Mt. Katsuragi (866m.) and Mt. Mikuni (886m.) are the highest. The cities also have wide agricultural areas in which there are many historical man-made lakes. Local industries such as textile and wood have long histories. The western parts of these cities face the Osaka Bay. The main rivers, such as Ushitaki (17534m.), Tsuda (9988m.) and Haruki (5720m.) in Kishiwada, Chikaki (15445m.) in Kaizuka, and Matsuo (12331m.) and Makio (15134m.) in Izumi, flow into the Osaka Bay. The Osaka Bay has been a plentiful site for fishery. However, since the 1960's, the Sakai-Senboku coastal complex has been developed during a high-speed period of economic growth, and paced with it the fishery sites have been drastically destroyed. The agricultural and forest areas also have not been exempt from destruction by over-extraction and industrial and residential developments.

In our research, primary industries (agriculture, forest and fishery) and secondary industries (local and newly developed) are evaluated in comparison with each other. However, for the primary industries, which are suffering from severe structural changes due to current patterns of economic growth, production factor availability and stability are selected as main objects for particular evaluations. Contrarily, for the secondary industries, which have already attained structural stabilities, only profitability is examined because, in principle, they have no difficulties for production factor input. The profitability is scrutinized separately for society (productivity), labourer (wage revenue) and entrepreneur (gross profit).

The problem structure is configurated in 7 layers in a hierarchical multi-level system. 130 attributes in total are chosen as objects for the assessment.

A type of single attribute utility function for each attribute is assumed to be the same among the three cities for the primary industries. For the secondary industries, the way to assess single attribute utility functions are classified from Category 1 to Category 5 according to average sizes of business establishments (Appendices I and II). Actually, parameters of each utility function for each attribute are assessed and calculated with these assigned types.

In Table 1, according to the problem structure, all the attributes and their coding are listed. Details of the attributes are explained in Table 2. Input data for the attributes such as their ranges (worst and best), certainty equivalents (CE), for which utility is 0.25, 0.50 and 0.75, and current values (CV) are listed in Table 3. Types of the single attribute utility function for the attributes are also shown in Table 3. Indifference points

Table 1. Problem Structure , List of Attributes and Coding.

Region: SENBOKU

Kishiwada: KI

Primal industry: KIP

Agriculture: KIPA

Factor availability: KIPAF

Agricultural machineryequipment:	KIPAFMC	X_1
Water: number of lakes	KIPAFWTN	X_2
Water: pondage of lakes	KIPAFWTV	X_3
Water: total length of rivers	KIPAFWTL	X_4
Labour force:	KIPAFLB	X_5

Profitability: KIPAP

Labor productivity:	KIPAPPD	X_6
Agricultural gross revenue:	KIPAPFD	X_7
Land price: rice field	KIPAPLPR	X_8
Land price: other fields	KIPAPLPF	X_9

Stability: KIPAS

Harvest area	KIPASHA	X_{10}
Number of types of farm products	KIPASCL	X_{11}
Change in number of farming families	KIPASHN	X_{12}

Forestry: KIPF

Factor availability: KIPFF

Labor force	KIPFFLB	X_{13}
Forest resource area	KIPFFFA	X_{14}

Stability: KIPFS		
Location condition	KIPFSCO	X_{15}
Forest density	KIPFSDN	X_{16}
Afforestation	KIPFSPT	X_{17}
Fishery: KIPS		
Factor availability: KIPSF		
Number of fishing boats	KIPSFFS	X_{18}
Labor force	KIPSFLB	X_{19}
Profitability: KIPSP		
A catch of fish	KIPSPFO	X_{20}
Stability: KIPSS		
Change in kind of fish	KIPSSCL	X_{21}
Change in number of employees	KIPSSNL	X_{22}
Secondary industry: KISI		
Local industry:KISIL		
Textile mill products: KISILTE		
Labor productivity	KISILTEL	X_{23}
Wage revenue	KISILTEW	X_{24}
Gross entrepreneurial revenue	KISILTEF	X_{25}
Apparel products: KISILAP		
Labor productivity	KISILAPL	X_{26}
Wage reveneue	KISILAPW	X_{27}
Gross entrepreneurial revenue	KISILAPF	X_{28}
Lumber and related products: KISILWO		
Labour productivity	KISILWOL	X_{29}
Wage revenue	KISILWOW	X_{30}
Gross entrepreneurial revenue	KISILWOF	X_{31}

Clay and Stone products: KISILCL

Labour productivity	KISILCLL	X_{32}
Wage revenue	KISILCLW	X_{33}
Gross entrepreneurial revenue	KISILCLF	X_{34}

Newly developed industry: KISIN

Iron and Steel: KISINSE

Labour productivity	KISINSEL	X_{35}
Wage revenue	KISINSEW	X_{36}
Gross entrepreneurial revenue	KISINSEF	X_{37}

Fabricated Metal products: KISINME

Labour productivity	KISINMEL	X_{38}
Wage revenue	KISINMEW	X_{39}
Gross entrepreneurial revenue	KISINMEF	X_{40}

Machinery: KISINMC

Labour productivity	KISINMCL	X_{41}
Wage revenue	KISINMCW	X_{42}
Gross entrepreneurial revenue	KISINMCF	X_{43}

Kaizuka: KA

Primal industry: KAP

Agriculture: KAPA

Factor availablility: KAPAF

Agricultural machinery equipment	KAPAFMC	X_{44}
Water: number of lakes	KAPAFWTN	X_{45}
water: pondage of lakes	KAPAFWTV	X_{46}
water: total length of rivers	KAPAFWTL	X_{47}
Labour force	KAPAFLB	X_{48}

Profitability: KAPAP

Land productivity	KAPAPPD	X_{49}
Agricultural gross revenue	KAPAPFD	X_{50}
Land price: rice field	KAPAPLPR	X_{51}
Land price: other fields	KAPAPLPF	X_{52}

Stability: KAPAS

Harvest area	KAPASHA	X_{53}
number of types of farm products	KAPASCL	X_{54}
change in number of farming families	KAPASHN	X_{55}

Forestry: KAPF

Factor availability: KAPFF

Labor force	KAPFFLB	X_{56}
Forest resource area	KAPFFFA	X_{57}

Stability: KAPFS

Location condition	KAPFSCO	X_{58}
Forest density	KAPFSDN	X_{59}
Afforestation	KAPFSPT	X_{60}

Fishery:KAPS

Factor availability: KAPSF

Number of fishing boats	KAPSFFS	X_{61}
Labour force	KAPSFLB	X_{62}

Profitability: KAPSP

A catch of fish	KAPSPFO	X_{63}

Stability: KAPSS

Change of type of fish	KAPSSCL	X_{64}
Change in number of employees	KAPSSNL	X_{65}

Second industry: KAS

Local industry: KASIL

Textile mill products: KASILTE

Labour productivity	KASILTEL	X_{66}
Wage revenue	KASILTEW	X_{67}
Gross entrepreneurial revenue	KASILTEF	X_{68}

Apparel Products: KASILAP

Labour productivity	KASILAPL	X_{69}
Wage revenue	KASILAPW	X_{70}
Gross entrepreneurial revenue	KASILAPF	X_{71}

Lumber and related products: KASILWO

Labour productivity	KASILWOL	X_{72}
Wage revenue	KASILWOW	X_{73}
Gross entrepreneurial revenue	KASILWOF	X_{74}

Clay and Stone products: KASILCL

Labour productivity	KASILCLL	X_{75}
Wage revenue	KASILCLW	X_{76}
Gross entrepreneurial revenue	KASILCLF	X_{77}

Newly developed industry: KASIN

Iron and Steel: KASINSE

Labour productivity	KASINSEL	X_{78}
Wage revenue	KASINSEW	X_{79}
Gross entrepreneurial revenue	KASINSEF	X_{80}

Fabricated metal products: KASINME

Labour productivity	KASINMEL	X_{81}
Wage revenue	KASINMEW	X_{82}
Gross entrepreneurial revenue	KASINMEF	X_{83}

Machinery: KASINMC

Labour productivity	KASINMCL	X_{84}
Wage Revenue	KASINMCW	X_{85}
Gross entrepreneurial revenue	KASINMCF	X_{86}

Izumi: IZ

Primal industry: IZP

Agriculture: IZPA

Factor availability: IZPAF

Agricultural machinery equipment	IZPAFMC	X_{87}
Water: number of lakes	IZPAFWTN	X_{88}
Water: pondage of lakes	IZPAFWTV	X_{89}
Water: total length of rivers	IZPAFWTL	X_{90}
Labour force	IZPAFLB	X_{91}

Profitability: IZPAP

Land productivity	IZPAPPD	X_{92}
Gross agricultural revenue	IZPAPFD	X_{93}
Land price: rice fields	IZPAPLPR	X_{94}
Land price: other fields	IZPAPLPF	X_{95}

Stability: IZPAS

Harvest area	IZPASHA	X_{96}
change in number of farm products	IZPASCL	X_{97}
change in number of farming families	IZPASHN	X_{98}

Forestry: IZPF

Factor availability: IZPFF

Labour force	IZPFFLB	X_{99}
Forest resource area	IZPFFFA	X_{100}

Stability: IZPFS

Location condition	IZPFSCO	X_{101}
Forest density	IZPFSDN	X_{102}
Afforestation	IZPFSPT	X_{103}

Secondary industry: IZS

Local industry: IZSIL

Textile Mill products: IZSILTE

Labour productivity	IZSILTEL	X_{104}
Wage revenue	IZSILTEW	X_{105}
Gross entrepreneurial revenue	IZSILTEF	X_{106}

Apparel products: IZSILAP

Labour productivity	IZSILAPL	X_{107}
Wage revenue	IZSILAPW	X_{108}
Gross entrepreneurial revenue	IZSILAPF	X_{109}

Lumber and related products: IZSILWO

Labour productivity	IZSILWOL	X_{110}
Wage revenue	IZSILWOW	X_{111}
Gross entrepeneurial revenue	IZSILWOF	X_{112}

Clay and Stone products : IZSILCL

Labour productivity	IZSILCLL	X_{113}
Wage revenue	IZSILCLW	X_{114}
Gross entrepeneurial revenue	IZSILCLF	X_{115}

Newly developed industry: IZSIN

Chemicals and related products: IZSINCH

Labour productivity	IZSINCHL	X_{116}
Wage revenue	IZSINCHW	X_{117}
Gross entreneurial revenue	IZSINCHF	X_{118}

<u>Iron and Steel: IZSINSE</u>

Labour productivity	IZSINSEL	X_{119}
Wage revenue	IZSINSEW	X_{120}
Gross entrepreneurial revenue	IZSINSEF	X_{121}

<u>Fabricated metal products: IZSINME</u>

Labour productivity	IZSINMEL	X_{122}
Wage revenue	IZSINMEW	X_{123}
Gross entrepreneurial revenue	IZSINMEF	X_{124}

<u>Machinery: IZSINMC</u>

Labour productivity	IZSINMCL	X_{125}
Wage revenue	IZSINMCW	X_{126}
Gross entrepreneurial revenue	IZSINMCF	X_{127}

<u>Non-ferrous metals: IZSINNM</u>

Labour productivity	IZSINNML	X_{128}
Wage Revenue	IZSINNMW	X_{129}
Gross entrereneurial revenue	IZSINNMF	X_{130}

TABLE 2. Details of Attributes

Measure	Attribute variable
Agriculture	
$\frac{\text{Number of agricultural machines}}{\text{Number of farming families}}$	X_1, X_{44}, X_{87}
$\frac{\text{Number of lakes}}{\text{Farming area (100 ha)}}$	X_2, X_{45}, X_{88}
$\frac{\text{Pondage of lakes(over 800.000m}^3\text{) (1000m}^3\text{)}}{\text{Farming area (100 ha)}}$	X_3, X_{46}, X_{89}
$\frac{\text{Total length of rivers (over 10.000m) (m)}}{\text{Farming area (100 ha)}}$	X_4, X_{47}, X_{90}
$\frac{\text{Number of independent farmers + agricultural employees}}{\text{Farming area (ha)}}$	X_5, X_{48}, X_{91}
$\frac{\text{Agricultural gross output (million yen)}}{\text{Farming area (ha)}}$	X_6, X_{49}, X_{92}
$\frac{\text{Agricultural gross output (million yen)}}{\text{Number of farming families}}$	X_7, X_{50}, X_{93}
$\frac{\text{Local rice field price (10000 yen/ha)}}{\text{National rice field price (10000 yen/ha}}$	X_8, X_{51}, X_{94}
$\frac{\text{Local other field price (10000 yen/ha)}}{\text{National other field price (10000 yen/ha}}$	X_9, X_{52}, X_{95}
$\frac{\text{Farming area (ha)}}{\text{Number of farming families}}$	X_{10}, X_{53}, X_{96}
Number of types of agricultural products (over 100a)	X_{11}, X_{54}, X_{97}
Change in farming families	X_{12}, X_{55}, X_{98}
Forestry	
$\frac{\text{Number of independent workers + employees}}{\text{Number of forestry firms}}$	X_{13}, X_{56}, X_{99}

$\frac{\text{Forest resource area (ha)}}{\text{Number of forestry firms}}$	X_{14}, X_{57}, X_{100}
$\frac{\text{Forest resource area (ha)}}{\text{City land area (ha)}}$	X_{15}, X_{58}, X_{101}
$\frac{\text{Forest resource accumulation } (1000m^3)}{\text{Forest resource area (ha)}}$	X_{16}, X_{59}, X_{102}
$\frac{\text{Afforestation area (ha)}}{\text{Forest resource area (ha)}}$	X_{17}, X_{60}, X_{103}

Fishery

$\frac{\text{Number of motor fishing boats}}{\text{Number of fishery firms}}$	X_{18}, X_{61}
$\frac{\text{Number of fishery workers}}{\text{Number of fishery firms}}$	X_{19}, X_{62}
$\frac{\text{A catch of fish (over 1000 kg)}}{\text{Number of fishery firms}}$	X_{20}, X_{63}
Change in number of types of fish	X_{21}, X_{64}
Change in number of fishery workers	X_{22}, X_{65}

Industry

$\frac{\text{Manufacturing shipment (million yen)}}{\text{Number of employees}}$	$X_{23}, X_{26}, X_{29}, X_{32}, X_{35}, X_{38}$ $X_{41}, X_{66}, X_{69}, X_{72}, X_{75}, X_{78}$ $X_{81}, X_{84}, X_{104}, X_{107}, X_{110}, X_{113},$ $X_{116}, X_{119}, X_{122}, X_{125}, X_{128},$
$\frac{\text{Total payroll (million yen)}}{\text{Number of employees}}$	$X_{24}, X_{27}, X_{30}, X_{33}, X_{36}, X_{39},$ $X_{42}, X_{67}, X_{70}, X_{73}, X_{76}, X_{79},$ $X_{82}, X_{85}, X_{105}, X_{108}, X_{111}, X_{114},$ $X_{117}, X_{120}, X_{123}, X_{126}, X_{129},$

$\frac{\text{Total gross value added million yen}}{\text{Number of firms}}$	$X_{25}, X_{28}, X_{31}, X_{34}, X_{37}, X_{40},$ $X_{43}, X_{68}, X_{71}, X_{74}, X_{77}, X_{80}$ $X_{83}, X_{86}, X_{106}, X_{109}, X_{112}, X_{115},$ $X_{118}, X_{121}, X_{124}, X_{127}, X_{130},$

TABLE 3 . INPUT DATA FOR ATTRIBUTES

Code	Worst	Best	CE ($U_{0.5}$)	($U_{0.25}$)	($U_{0.75}$)	CV	Utility Type
KIPAFMC	0.0	3.00	1.25			1.5	3
KIPAFWTN	0.0	50.00	10.00			39.47	3
KIPAFWTV	0.0	500.00	80.00	25.0	190.0	145.19	4
KIPAFWTL	0.0	5000.00	2000.00			3229.60	3
KIPAFLB	0.0	10.00	4.50			5.58	3
KIPAPPD	0.0	8.00	3.00	1.25	5.35	3.53	4
KIPAPFD	0.0	6.00	2.00			1.41	3
KIPAPLPR	0.0	30.00	2.50	0.8	7.0	6.93	4
KIPAPLPF	0.0	30.00	2.50	0.9	8.5	5.43	4
KIPASHA	0.0	5.00	0.80	0.22	1.8	0.40	4
KIPASCL	0.0	30.00	10.00	4.0	18.75	19.00	4
KIPASHN	0.0	2.00	0.85	0.35	1.4	0.85	4
KIPFFLB	0.0	1.00	0.30	0.1	0.63	0.164	4
KIPFFFA	0.0	10.00	5.00			6.75	1
KIPFSCO	0.0	0.90	0.30	0.11	0.55	0.27	4
KIPFSDN	0.0	200.00	80.00	34.0	138.0	95.24	4
KIPFSPT	0.0	0.05	0.01	0.003	0.0215	0.0033	4
KIPSFFS	0.0	10.00	2.25	0.91	4.82	2.98	4
KIPSFLB	0.0	10.00	3.00			3.50	3
KIPSPFO	0.0	1000.00	200.00	37.0	531.00	289.50	4
KIPSSCL	0.0	2.00	0.75	0.30	1.35	0.93	4
KIPSSNL	0.0	2.00	0.825	0.35	1.40	0.75	4
KISILTEL	0.0	20.00	10.00			8.40	1
KISILTEW	0.0	6.00	3.80			1.29	3
KISILTEF	0.0	100.00	50.00			23.60	1
KISILAPL	0.0	20.00	10.00			6.80	1
KISILAPW	0.0	6.00	3.80			1.18	3
KISILAPF	0.0	100.00	50.00			24.60	1
KISILWOL	0.0	30.00	11.00			12.90	3
KISILWOW	0.0	6.00	2.50			1.93	3
KISILWOF	0.0	300.0	100.00			136.60	3
KISILCLL	0.0	30.00	11.00			13.20	3
KISILCLW	0.0	6.00	2.50			2.03	3
KISILCLF	0.0	300.0	100.00			177.50	3

Code	Worst	Best	CE ($U_{0.5}$)	($U_{0.25}$)	($U_{0.75}$)	CV	Utility Type
KISINSEL	0.0	30.00	100.00	3.50	19.00	16.70	4
KISINSEW	0.0	6.00	1.80	0.73	3.41	2.73	4
KISINSEF	0.0	700.00	150.00	47.00	330.00	225.20	4
KISINMEL	0.0	20.00	10.00			13.40	1
KISINMEW	0.0	6.00	3.00			2.34	1
KISINMEF	0.0	200.00	75.00			92.10	3
KISINMCL	0.0	20.00	10.00			7.60	1
KISINMCW	0.0	6.00	3.80			2.07	3
KISINMCF	0.0	100.00	50.00			42.20	1
KAPAFMC	0.0	3.00	1.25			2.02	3
KAPAFWTN	0.0	50.00	10.00			26.40	3
KAPAFWTV	0.0	500.00	80.00	25.00	190.0	77.00	4
KAPAFWTL	0.0	5000.00	2000.00			3426.50	3
KAPAFLB	0.0	10.00	4.50			6.48	3
KAPAPPD	0.0	8.00	3.00	1.25	5.35	4.19	4
KAPAPFD	0.0	6.00	2.00			1.55	3
KAPAPLPR	0.0	30.00	2.50	0.80	7.00	3.53	4
KAPAPLPF	0.0	30.00	2.50	0.90	8.50	3.20	4
KAPASHA	0.0	5.00	0.80	0.22	1.80	0.37	4
KAPASCL	0.0	30.00	10.00	4.00	18.75	15.00	4
KAPASHN	0.0	2.00	0.85	0.35	1.40	0.79	4
KAPFFLB	0.0	1.00	0.30	0.10	0.63	0.10	4
KAPFFFA	0.0	10.00	5.00			6.56	1
KAPFSCO	0.0	0.90	0.30	0.11	0.55	0.45	4
KAPFSDN	0.0	200.00	80.00	34.00	138.00	97.74	4
KAPFSPT	0.0	0.05	0.01	0.003	0.0215	0.0053	4
KAPSFFS	0.0	10.00	2.25	0.91	4.82	0.0	4
KAPSFLB	0.0	10.00	3.00			0.72	3
KAPSPFO	0.0	1000.00	200.00	37.00	531.00	2.00	4
KAPSSCL	0.0	2.00	0.75	0.30	1.35	0.85	4
KAPSSNL	0.0	2.00	0.825	0.35	1.40	0.25	4
KASILTEL	0.0	20.00	10.00			8.70	1
KASILTEW	0.0	6.00	3.00			1.46	1
KASILTEF	0.0	200.00	75.00			63.30	3
KASILAPL	0.0	20.00	10.00			3.10	1
KASILAPW	0.0	6.00	3.80			1.09	3
KASILAPF	0.0	100.00	50.00			23.70	1

Code	Worst	Best	CE ($U_{0.5}$)	($U_{0.25}$)	($U_{0.75}$)	CV	Utility Type
KASILWOL	0.0	20.00	10.00			12.70	1
KASILWOW	0.0	6.00	3.80			1.71	3
KASILWOF	0.0	100.00	50.00			33.60	1
KASILCLL	0.0	30.00	11.00			9.50	3
KASILCLW	0.0	6.00	2.50			1.72	3
KASILCLF	0.0	300.00	100.00			203.90	3
KASINSEL	0.0	30.00	11.00			16.30	3
KASINSEW	0.0	6.00	2.50			2.47	3
KASINSEF	0.0	300.00	100.00			178.90	3
KASINMEL	0.0	20.00	10.00			12.40	1
KASINMEW	0.0	6.00	3.80			2.16	3
KASINMEF	0.0	100.00	50.00			48.00	1
KASINMCL	0.0	20.00	10.00			8.10	1
KASINMCW	0.0	6.00	3.80			2.15	3
KASINMCF	0.0	100.00	50.00			53.50	1
IZPAFMC	0.0	3.00	1.25			1.45	3
IZPAFWTN	0.0	50.00	10.00			20.75	3
IZPAFWTV	0.0	500.00	80.00	25.0	190.00	386.62	4
IZPAFWTL	0.0	5000.00	2000.00			2150.60	3
IZPAFLB	0.0	10.00	4.50			6.75	3
IZPAPPD	0.0	8.00	3.00	1.25	5.35	3.44	4
IZPAPFD	0.0	6.00	2.00			1.37	3
IZPAPLPR	0.0	30.00	2.50	0.80	7.00	8.74	4
IZPAPLPF	0.0	30.00	2.50	0.90	8.50	7.35	4
IZPASHA	0.0	5.00	0.80	0.22	1.80	0.40	4
IZPASCL	0.0	30.00	10.00	4.00	18.75	18.00	4
IZPASHN	0.0	2.00	0.85	0.35	1.40	0.91	4
IZPFFLB	0.0	1.00	0.30	0.10	0.63	0.297	4
IZPFFFA	0.0	10.00	5.00			6.43	1
IZPFSCO	0.0	0.90	0.30	0.11	0.55	0.36	4
IZPFSDN	0.0	200.00	80.00	34.00	138.00	100.74	4
IZPFSPT	0.0	0.05	0.01	0.003	0.0215	0.0087	4
IZSILTEL	0.0	20.00	10.00			11.40	1
IZSILTEW	0.0	6.00	3.80			1.40	3
IZSILTEF	0.0	100.00	50.00			17.50	1

Code	Worst	Best	CE ($U_{0.5}$)	($U_{0.25}$)	($U_{0.75}$)	CV	Utility Type
IZSILAPL	0.0	20.00	10.00			5.2	1
IZSILAPW	0.0	6.00	3.80			1.2	3
IZSILAPF	0.0	100.00	50.00			35.20	1
IZSILWOL	0.0	20.00	11.60			5.70	3
IZSILWOW	0.0	6.00	4.50	3.10	5.40	1.56	5
IZSILWOF	0.0	20.00	11.40			7.30	3
IZSILCLL	0.0	20.00	10.00			8.40	1
IZSILCLW	0.0	6.00	3.80			1.46	3
IZSILCLF	0.0	100.00	50.00			18.30	1
IZSINCHL	0.0	30.00	10.00	3.50	19.00	21.93	4
IZSINCHW	0.0	6.00	1.80	0.73	3.41	1.94	4
IZSINCHF	0.0	700.00	150.00	47.00	330.00	184.40	4
IZSINSEL	0.0	30.00	10.00	3.50	19.00	18.90	4
IZSINSEW	0.0	6.00	1.80	0.73	3.41	2.71	4
IZSINSEF	0.0	700.00	150.00	3.50	190.00	366.90	4
IZSINMEL	0.0	20.00	10.00			8.00	1
IZSINMEW	0.0	6.00	3.80			1.65	3
IZSINMEF	0.0	100.00	50.00			32.80	1
IZSINMCL	0.0	20.00	10.00			9.70	1
IZSINMCW	0.0	6.00	3.80			1.53	3
IZSINMCF	0.0	100.00	50.00			35.90	1
IZSINNML	0.0	30.00	10.00	3.50	19.00	13.80	4
IZSINNMW	0.0	6.00	1.80	0.73	3.41	2.26	4
IZSINNMF	0.0	700.00	150.00	47.00	330.00	602.00	4

Table 4 . Indifference points and Scaling constants

Indifference points	Scaling constants
Kishiwada	
(KIPAFWTN, KIPAFWTV)	k KIPAFWTN = 0.9000
(20.0, 0.0) ~ (0.0, 500.0)	k KIPAFWTV = 0.6835
(KIPAFWTN, KIPAFWTL)	k KIPAFWTL = 0.4500
(10.0, 0.0) ~ (0.0, 5000.0)	K(KIPAFWT) =-0.97656
(KIPAPLPR. KIPAPLPF)	k KIPAPPR = 0.9000
(10.0, 0.0) ~ (0.0, 30.0)	k KIPAPLPF = 0.7541
	K(KIPAPLP) =-0.9648
(KIPAFLB, KIPAFWT)	k KIPAFMC = 0.2218
(0.35, 0.0) ~ (0.0, 1.0)	k KIPAFWT = 0.3325
(KIPAFLB, KIPAFMC)	k KIPAFLB = 0.9500
(2.0, 0.0) ~ (0.0, 3.0)	K(KIPAF) =-0.9453
(KIPAPFD, KIPAPPD)	k KIPAPPD = 0.2955
(1.2, 0.0) ~ (0.0, 8.0)	k KIPAPFD = 0.9000
(KIPAPFD, KIPAPLP)	k KIPAPLP = 0.2700
(0.3, 0.0) ~ (0.0, 1.0)	K(KIPAP) =-0.8867
(KIPASHA, KIPASCL)	k KIPASHA = 0.9500
(1.0, 0.0) ~ (0.0, 30.0)	k KIPASCL = 0.5350
(KIPASHA, KIPASHN)	k KIPASHN = 0.3690
(0.5, 0.0) ~ (0.0, 2.0)	K(KIPAS) =-0.9785
(KIPFFLB, KIPFFFA)	k KIPFFLB = 0.8000
(0.3, 0.0) ~ (0.0, 10.0)	k KIPFFFA = 0.4000
	K(KIPFF) =-0.6250
(KIPFSCO, KIPFSDN)	k KIPFSCO = 0.9000
(0.2, 0.0) ~ (0.0, 200.0)	k KIPFSDN = 0.3400
(KIPFSCO, KIPFSPT)	k KIPFSPT = 0.2105
(0.1, 0.0) ~ (0.0, 0.05)	K(KIPFS) =-0.8828
(KIPSFLB, KIPSFFS)	k KIPSFFS = 0.0163
(0.08, 0.0)~ (0.0, 10.0)	k KIPSFLB = 0.9500
	K(KIPSF) = 2.1875
(KIPSSCL, KIPSSNL)	k KIPSSCL = 0.8000
(0.5, 0.0) ~ (0.0, 2.0)	k KIPSSNL = 0.2985
	K(KIPSS) =-0.4063
(KIPAF, KIPAS)	k KIPAF = 0.9000
(0.23, 0.0) ~ (0.0, 1.0)	k KIPAP = 0.1350
(KIPAF, KIPAP)	k KIPAS = 0.2070
(0.15, 0.0) ~ (0.0, 1.0)	K(KIPA) =-0.7656
KIPFS, KIPFF)	k KIPFF = 0.3400
(0.4, 0.0) ~ (0.0, 1.0)	k KIPFS = 0.8500
	K(KIPF) =-0.6563

(KIPSP, KIPSS) (0.53, 0.0) ~ (0.0, 1.0) (KIPSPFO, KIPSF) (0.49, 0.0) ~ (0.0, 1.0)	k KIPSF = 0.4655 k KIPSP = 0.9500 k KIPSS = 0.5035 K(KIPS) =-0.9805
(KIPA, KIPS) (0.15, 0.0) ~ (0.0, 1.0) (KIPA, KIPF) (0.125, 0.0) ~ (0.0, 1.0)	k KIPA = 0.9000 k KIPF = 0.1125 k KIPS = 0.1350 K(KIP) =-0.6406
(KISILTEW, KISILTEF) (1.0, 0.0) ~ (0.0, 100.0) (KISILTEW, KISILTEL) (0.3, 0.0) ~ (0.0, 20.0)	k KISILTEL = 0.0251 k KISILTEW = 0.9000 k KISILTEF = 0.0894 K(KISILTE) =-0.1250
(KISILAPW, KISILAPF) (0.6, 0.0) ~ (0.0, 100.0) (KISILAPW, KISILAPL) (0.3, 0.0) ~ (0.0, 1.0)	k KISILAPL = 0.0237 k KISILAPW = 0.8500 k KISILAPF = 0.0488 K(KISILAP) = 1.2188
(KISILWOL, KISILWOW) (10.0, 0.0) ~ (0.0, 6.0) (KISILWOL, KISILWOF) (3.0, 0.0) ~ (0.0, 300.0)	k KISILWOL = 0.8000 k KISILWOW = 0.3700 k KISILWOF = 0.1259 K(KISILWO) =-0.7109
(KISILCLL, KISILCLW) (7.5, 0.0) ~ (0.0, 6.0) (KISILCLL, KISILCLF) (5.0, 0.0) ~ (0.0, 300.0)	k KISILCLL = 0.8000 k KISILCLW = 0.2901 k KISILCLF = 0.2023 K(KISILCL) =-0.6953
(KISINSEW, KISINSEL) (1.0, 0.0) ~ (0.0, 30.0) (KISINSEW, KISINSEF) (0.8, 0.0) ~ (0.0, 700.0)	k KISINSEL = 0.2745 k KISINSEW = 0.8500 k KISINSEF = 0.2293 K(KISINSE) =-0.7891
(KISINMEW, MISINMEF) (0.8, 0.0) ~ (0.0, 200.0) (KISINMEW, KISINMEL) (0.4, 0.0) ~ (0.0, 20.0)	k KISINMEL = 0.0567 k KISINMEW = 0.8500 k KISINMEF = 0.1133 K(KISINME) =-0.1250
(KISINMCL, KISINMCF) (2.0, 0.0) ~ (0.0, 100.0) (KISINMCL, KISINMCW) (1.0, 0.0) ~ (0.0, 6.0)	k KISINMCL = 0.9500 k KISINMCW = 0.0475 k KISINMCF = 0.0950 K(KISINMC) =-0.6719
(KISILTE, KISILAP) (0.12, 0.0) ~ (0.0, 1.0) (KISILTE, KISILWO) (0.1, 0.0) ~ (0.0, 1.0) (KISILTE, KISILCL) (0.06, 0.0) ~ (0.0, 1.0)	k KISILTE = 0.9000 k KISILAP = 0.1080 k KISILWO = 0.0900 k KISILCL = 0.0540 K(KISIL) =-0.6406

(KISINME, KISINMC) (0.2, 0.0)~(0.0, 1.0) (KISINME, KISINSE) (0.16, 0.0) ~ (0.0, 1.0)	k KISINSE = 0.1440 k KISINME = 0.9000 k KISINMC = 0.1800 K(KISIN) =-0.7500
(KISIL, KISIN) (0.12, 0.0) ~ (0.0, 1.0)	k KISIL = 0.8500 k KISIN = 0.1020 K (KISI) =-0.5625
(KIP, KISI) (0.23, 0.0) ~ (0.0, 1.0)	k KIP = 0.9000 k KISI = 0.2070 K (KI) =-0.5781

<u>Kaizuka</u>

(KAPAFWTL, KAPAFWTN) (2000.0. 0.0) ~ (0.0, 1.0) (KAPAFWTL, KAPAFWTV) (1500.0, 0.0) ~ (0.0, 1.0)	k KAPAFWTN = 0.4500 k KAPAFWTV = 0.3510 k KAPAFWTL = 0.9000 K(KAPAFWT) =-0.9414
(KAPAPLPR, KAPAPLPF) (10.0, 0.0) ~ (0.0, 30.0)	k KAPAPLPR = 0.9000 k KAPAPLPF = 0.7541 K(KAPAPLP) =-0.9648
(KAPAFWT, KAPAFLB) (0.4, 0.0) ~ (0.0, 1.0) (KAPAFWT, KAPAFMC) (0.27, 0.0) ~ (0.0, 1.0)	k KAPAFMC = 0.2295 k KAPAFWT = 0.8500 k KAPAFLB = 0.3400 K (KAPAF) =-0.8281
(KAPAPFD, KAPAPPD) (1.5, 0.0) ~ (0.0, 8.0) (KAPAPED, KAPAPLP) (0.35, 0.0) ~ (0.0, 1.0)	k KAPAPPD = 0.3371 k KAPAPFD = 0.8500 k KAPAPLP = 0.2975 K(KAPAP) =-0.8555
(KAPASHA, KAPASCL) (0.5, 0.0) ~ (0.0, 30.0) (KAPASHA, KAPASHN) (0.2, 0.0) ~ (0.0, 2.0)	k KAPASHA = 0.9500 k KAPASCL = 0.3690 k KAPASHN = 0.2249 K(KAPAS) =-0.9492
(KAPFFFA, KAPFFLB) (2.0, 0.0) ~ (0.0, 1.0)	k KAPFFLB = 0.1800 k KAPFFFA = 0.9000 K(KAPFF) =-0.5000
(KAPFSCO, KAPFSPT) (0.1, 0.0) ~ (0.0, 0.05) (KAPFSCO, KAPFSDN) (0.06, 0.0) ~ (0.0, 200.0)	k KAPFSCO = 0.9500 k KAPFSDN = 0.1535 k KAPFSPT = 0.2222 K(KAPFS) =-0.8984
(KAPSFLB, KAPSFFS) (1.5, 0.0) ~ (0.0, 10.0)	k KAPSFFS = 0.2552 k KAPSFLB = 0.9000 K(KAPSF) =-0.6719

(KAPSSCL, KAPSSNL) (0.8, 0.0) ~ (0.0, 2.0)	k KAPSSCL = 0.7500 k KAPSSNL = 0.3922 K (KAPSS) =-0.4844
(KAPAS, KAPAF) (0.54, 0.0) ~ (0.0, 1.0) (KAPAS, KAPAP) (0.4, 0.0) ~ (0.0, 1.0)	k KAPAF = 0.4860 k KAPAP = 0.3600 k KAPAS = 0.9000 K(KAPA) =-0.9492
(KAPFS, KAPFF) (0.41, 0.0) ~ (0.0, 1.0)	k KAPFF = 0.3690 k KAPFS = 0.9000 K(KAPF) =-0.8125
(KAPSS, KAPSP (0.47, 0.0) ~ (0.0, 1.0) (KAPSS, KAPSF) (0.37, 0.0) ~ (0.0, 1.0)	k KAPSF = 0.2960 k KAPSP = 0.3760 k KAPSS = 0.8000 K(KAPS) =-0.8203
(KAPA, KAPF) (0.5, 0.0) ~ (0.0, 1.0) (KAPA, KAPS) (0.4, 0.0) ~ (0.0, 1.0)	k KAPA = 0.9000 k KAPF = 0.4500 k KAPS = 0.3600 K(KAP) =-0.9414
(KASILTEW, KASILTEF) (0.6, 0.0) ~ (0.0, 200.0) (KASILTEW, KASILTEL) (0.3, 0.0) ~ (0.0, 20.0)	k KASILTEL = 0.0433 k KASILTEW = 0.8700 k KASILTEF = 0.0868 K(KASILTE) = 0.0
(KASILAPL, KASILAPW) (3.7, 0.0) ~ (0.0, 6.0) (KASILAPL, KASILAPF) (2.0, 0.0) ~ (0.0, 100.0)	k KASILAPL = 0.9000 k KASILAPW = 0.1665 k KASILAPF = 0.0900 K(KASILAP) =-0.6563
(KASILWOL, KASILWOF) (6.0, 0.0) ~ (0.0, 100.0) (KASILWOL, KASILWOW) (3.0, 0.0) ~ (0.0, 6.0)	k KASILWOL = 0.8500 k KASILWOW = 0.1275 k KASILWOF = 0.2550 K(KASILWO) =-0.6875
(KASILCLW, KASILCLL) (1.0, 0.0) ~ (0.0, 30.0) (KASILCLW, KASILCLF) (0.6, 0.0) ~ (0.0, 300.0)	k KASILCLL = 0.1954 k KASILCLW = 0.9000 k KASILCLF = 0.1199 K(KASILCL) =-0.7344
KASINSEW, KASINSEF) (1.0, 0.0) ~ (0.0, 300.0) (KASINSEW, KASINSEL) (0.6, 0.0) ~ (0.0, 30.0)	k KASINSEL = 0.1199 k KASINSEW = 0.9000 k KASINSEF = 0.1954 K(KASINSE) =-0.7344
(KASINMEW, KASINMEF) (1.2, 0.0) ~ (0.0, 100.0) (KASINMEW, KASINMEL) (1.0, 0.0) ~ (0.0, 20.0)	k KASINMEL = 0.0894 k KASINMEW = 0.9000 k KASINMEF = 0.1094 K(KASINME) =-0.5313
(KASINMCL, KASINMCF) (3.0, 0.0) ~ (0.0, 100.0) (KASINMCL, KASINMCW) (2.0, 0.0) ~ (0.0, 6.0)	k KASINMCL = 0.9000 k KASINMCW = 0.0900 k KASINMCF = 0.1350 K(KASINMC) =-0.5938

(KASILAP, KASILWO)	k KASILTE = 0.3150
(0.4, 0.0) ~ (0.0, 1.0)	k KASILAP = 0.9000
(KASILAP, KASILTE)	k KASILWO = 0.3600
(0.35, 0.0) ~ (0.0, 1.0)	k KASILCL = 0.1800
(KASILAP. KASILCL)	K(KASIL) =-0.9414
(0.2, 0.0) ~ (0.0, 1.0)	
(KASINME, KASINMC)	k KASINSE = 0.1080
(0.15, 0.0)~(0.0, 1.0)	k JASINME = 0.9000
(KASINME, KASINSE)	k KASINMC = 0.1350
(0.12, 0.0) ~ (0.0, 1.0)	K(KASIN) =-0.6406
(KASIL, KASIN)	k KASIL = 0.9000
(0.15, 0.0) ~ (0.0, 1.0)	k KASIN = 0.1350
	K(KASI) =-0.3125
(KAP, KASI)	k KAP = 0.9000
(0.4, 0.0) ~ (0.0, 1.0)	k KASI = 0.3600
	K(KA) =-8.8047

Izumi

(IZPAFWTV, IZPAFWTN)	k IZPAFWTN = 0.6128
(200.0, 0.0) ~ (0.0, 50.0)	k IZPAFWTV = 0.8000
(IZPAFWTV, IZPAFWTL)	k IZPAFWTL = 0.5415
(150.0, 0.0) ~ (0.0, 5000.0)	K(IZPAFWT) =-0.9531
(IZPAPLPR, IZPAPLPF)	k IZPAPLPR = 0.9000
(10.0, 0.0) ~ (0.0, 30.0)	k IZPAPLPF = 0.7541
	K(IZPAPLP) =-0.9648
(IZPAFMC, IZPAFWT)	k IZPAFMC = 0.8000
(0.45, 0.0) ~ (0.0, 1.0)	k IZPAFWT = 0.3600
(IZPAFMC, IZPAFLB)	k IZPAFLB = 0.2534
(0.75, 0.0) ~ (0.0, 10.0)	K(IZPAF) =-0.7891
(IZPAPFD, IZPAPPD)	k IZPAPPD = 0.2659
(1.0, 0.0) ~ (0.0, 8.0)	k IZPAPFD = 0.9500
(IZPAPFD, IZPAPLP)	k IZPAPLP = 0.1330
(0.14, 0.0) ~ (0.0, 1.0)	K(IZPAP) =-0.9063
(IZPASHA, IZPASCL)	k IZPASHA = 0.9000
(1.0, 0.0) ~ (0.0, 30.0)	k IZPASCL = 0.5069
(IZPASHA, IZPASHN)	k IZPASHN = 0.3496
(0.5, 0.0) ~ (0.0, 2.0)	K(IZPAS) =-0.9492
(IZPFFLB, IZPFFFA)	k IZPFFLB = 0.7000
(0.33, 0.0) ~ (0.0, 10.0)	k IZPFFFA = 0.3685
	K(IZPFF) =-0.2500
(IZPFSPT, IZPFSCO)	k IZPFSCO = 0.4750
(0.01, 0.0) ~ (0.0, 0.9)	k IZPFSDN = 0.3197
(IZPFSPT, IZPFSDN)	k IZPFSPT = 0.9500
(0.005, 0.0) ~ (0.0, 200.0)	K(IZPFS) =-0.9723

(IZPAF, IZPAS)	k IZPAF = 0.8500
(0.31, 0.0) ~ (0.0, 1.0)	k IZPAP = 0.1700
(IZPAF, IZPAP)	k IZPAS = 0.2635
(0.2, 0.0) ~ (0.0, 1.0)	K(IZPA) =-0.7344
(IZPFS, IZPFF)	k IZPFF = 0.4750
(o.5, 0.0) ~ (0.0, 1.0)	k IZPFS = 0.9500
	K(IZPF) =-0.9414
(IZPF, IZPA)	k IZPA = 0.4250
(0.5, 0.0) ~ (0.0, 1.0)	k IZPF = 0.8500
	K(IZP) =-0.7578
(IZSILTEF, IZSILTEW)	k IZSILTEL = 0.1700
(60.0, 0.0) ~ (0.0, 6.0)	k IZSILTEW = 0.5100
(IZSILTEF, IZSILTEL)	k IZSILTEF = 0.8500
(20.0, 0.0) ~ (0.0, 20.0)	K(IZSILTE) =-0.8828
(IZSILAPL, IZSILAPW)	k IZSILAPL = 0.8500
(4.0, 0.0) ~ (0.0, 6.0)	k IZSILAPW = 0.1700
(IZSILAPL, IZSILAPF)	k IZSILAPF = 0.0850
(2.0, 0.0) ~ (0.0, 100.0)	K(IZSILAP) =-0.4688
(IZSILWOL, IZSILWOF)	k IZSILWOL = 0.9000
(4.0, 0.0) ~ (0.0, 20.0)	k IZSILWOW = 0.0660
(IZSILWOL, IZSILWOW)	k IZSILWOF = 0.1364
(2.0, 0.0) ~ (0.0, 6.0)	K(IZSILWO) =-0.5469
(IZSILCLW, IZSILCLF	k IZSILCLL = 0.0265
(0.6, 0.0) ~ (0.0, 100.0)	k IZSILCLW = 0.9500
(IZSILCLW, IZSILCLL)	k IZSILCLF = 0.0545
(0.3, 0.0) ~ (0.0, 20.0)	K(IZSILCL) =-0.3750
(IZSINCHW, IZSINCHF)	k IZSINCHL = 0.0968
(0.8, 0.0) ~ (0.0, 700.0)	k IZSINCHW = 0.8500
(IZSINCHW, IZSINCHL)	k IZSINCHF = 0.2293
(0.3, 0.0) ~ (0.0, 30.0)	K(IZSINCH) =-0.6094
(IZSINSEW, IZSINSEF)	k IZSINSEL = 0.1259
(0.6, 0.0) ~ (0.0, 700.0)	k IZSINSEW = 0.8500
(IZSINSEW, IZSINSEL)	k IZSINSEF = 0.1800
(0.4, 0.0) ~ (0.0, 30.0)	K(IZSINSE) =-0.5781
(IZSINMEL, IZSINMEF)	k IZSINMEL = 0.8500
(4.0, 0.0) ~ (0.0, 100.0)	k IZSINMEW = 0.0850
(IZSINMEL, IZSINMEW)	k IZSINMEF = 0.1700
(2.0, 0.0) ~ (0.0, 6.0)	K(IZSINME) =-0.4688
(IZSINMCL, IZSINMCF)	k IZSINMCL = 0.8500
(5.0, 0.0) ~ (0.0, 100.0)	k IZSINMCW = 0.1700
(IZSINMCL, IZSINMCW)	k IZSINMCF = 0.2125
(4.0, 0.0) ~ (0.0, 6.0)	K(IZSINMC) =-0.6875
(IZSINNML, IZSINNMW)	k IZSINNML = 0.8500
(5.0, 0.0) ~ (0.0, 6.0)	k IZSINNMW = 0.2725
(IZSINNML, IZSINNMF)	k IZSINNMF = 0.1897
(3.0, 0.0) ~ (0.0, 700.0)	K(IZSINNM) =-0.7578

(IZSILWO, IZSILTE)	k IZSILTE = 0.2070
(0.23, 0.0) ~ (0.0, 1.0)	k IZSILAP = 0.0990
(IZSILWO, IZSILCL)	k IZSILWO = 0.9000
(0.15, 0.0) ~ (0.0, 1.0)	k IZSILCL = 0.1350
(IZSILWO, IZSILAP)	K(IZSIL) =-0.8281
(0.11, 0.0) ~ (0.0, 1.0)	

(IZSINME, IZSINMC)	k IZSINCH = 0.0900
(0.2, 0.0) ~ (0.0, 1.0)	k IZSINSE = 0.0450
(IZSINME, IZSINCH)	k IZSINME = 0.9000
(0.1, 0.0) ~ (0.0, 1.0)	k IZSINMC = 0.1800
(IZSINME, IZSINSE)	k IZSINNM = 0.0225
(0.05, 0.0) ~ (0.0, 1.0)	K(IZSIN) =-0.7500
(IZSINME, IZSINNM)	
(0.025, 0.0) ~ (0.0, 1.0)	

(IZSIL, IZSIN)	k IZSIL = 0.9000
(0.07, 0.0) ~ (0.0, 1.0)	k IZSIN = 0.0630
	K(IZSI) =-0.6250

(IZP, IZSI)	k IZP = 0.9500
(0.07, 0.0) ~ (0.0, 1.0)	k IZSI = 0.0665
	K(IZ) =-0.2500

and scaling constants for deriving multiattribute utility functions in each layer are described in Table 4.

In the following, some results of runs under TSS of ACOS-6 in the computer center of Kobe University in Japan are illustrated.

Illustration 1. An example of the INPUT command is listed. Inputting data is started by specifying the name of an overall MUF SENBOKU. After inputting the number of the attributes 3 and their names (KI,KA,IZ), the program asks whether the job should continue or not. During the process of data input, the user can interrupt the input work and restart it once again from the interrupted spots. This device is useful for input work for a large-scale data set.

Illustration 2. The STRUCT command is utilized for displaying the overall problem structure in a tree diagram in seven layers.

Illustration 3. Using the UNISET command, component utility functions are assessed. Here three attributes IZPAFWTN, IZPAFWTV and IZPAFWTL are shown and decreasing risk averse as well as constant risk averse types of the single attribute utility functions for these attributes are demonstrated.

Illustration 4. The shape of the above component utility functions is listed graphically with the GRAPHU command. Thus the user can check the properties of his utility function visually.

Illustration 5. Using the KSET command, the scaling constants of a MUF IZPAFWT are calculated. Here the second one of three types of methods for assessing the k_i and K is used.

Illustration 6. The GRAPHI command is utilized to list the indifference curves between IZPAFWTN and IZPAFWTL and between IZPAFWTV and IZPAFWTN. Better understanding properties of the indifference curves with graphical representation will facilitate to conduct sensitivity analysis.

Illustration 7. Indifference points among the attributes IZPAFWTV, IZPAFWTN, IZPAFWTL which have been assessed with the assigned k_i and K values are calculated and listed with the IMAP command.

Illustration 8. Using the DEBUG command, input information on all utility functions in each layer of the hierarchical system is listed sequentially. For MUF, the scaling constants K's are listed along with MUF names. For UNIF, the scaling constants k_i's, utility types and ranges of attributes are listed along with the UNIF or attribute names.

Illustration 9. Using the DISPLAY command, characteristics of the utility functions are individually depicted. For MUF, the MUF structure is listed with scaling constants k_i and K. For UNIF, range of attribute, utility type and parameters are listed.

Illustration 10. To evaluate the actual values of utility functions, current values in 1975 of all the attributes are set as input data using the ADDALT command. A data set for current values of attributes is called ALT1. The attributes can be certain or uncertain quantities. In the case of uncertain quantities, three types of probability distribution are available for assessment. In this paper all attributes are treated as certain quantities.

Illustration 11. The EVAL command calculates the numerical values of all the utility functions in ALT1 and lists.

Illustration 12. The GRAD command is utilized to perform sensitivity analysis for ALT1.

After examining the results of sensitivity analysis, seventeen attributes, for which utility values are highly sensitive to marginal changes of the attribute values, are chosen, i.e., KIPSPFO, KIPAFMC, KIPAFLB, KIPASHA, KISILTEW, KAPASHA, KAPASCL, KAPFSCO, KAPSSCL, KASILAPL, IZPAFMC, IZPFFLB, IZPFFFA, IZPFSCO, IZPFSDN, IZPFSPT, IZSILWOL.

Alternative policies for improving current situations are presented based on these selected attributes (Tables 5 and 6). To improve all the attributes at the same time is supposed to be infeasible because of financial restrictions. Thus, alternative scenarios which are incompatible with each other are constructed.

Table 5. Alternative Policies

Scenarios	Attributes whose values are changed
ALT2: second industries oriented	KISILTEW, KASILAPL, IZSILWOL
ALT3: primal industries oriented	KIPSPFO, KIPAFMC, KIPAFLB KIPASHA, KAPASHA, KAPASCL KAPFSCO, KAPSSCL, IZPAFMC IZPFFLB, IZPFFFA, IZPFSCO IZPFSDN, IZPFSPT

Table 6. The Changed Values for Alternative Scenarios

Attribute	Current Value	Revised Value	Note
ALT2:			
KISILTEW	1.29	1.55	+20%
KASILAPL	3.1	4.0	+30%
IZSILWOL	5.7	7.4	+30%
ALT3:			
KIPSPFO	289.5	318.45	+10%
KIPAFMC	1.50	1.65	+10%
KIPAFLB	5.58	6.14	+10%
KIPASHA	0.40	0.42	+ 5%
KAPASHA	0.37	0.39	+ 5%
KAPASCL	15.0	15.8	+ 5%
KAPFSCO	0.45	0.46	+ 3%
KAPSSCL	0.85	0.88	+ 3%
IZPAFMC	1.45	1.60	+10%
IZPFFLB	0.297	0.327	+10%
IZPFFFA	6.43	6.62	+ 3%
IZPFSCO	0.36	0.37	+ 3%
IZPFSDN	100.74	103.76	+ 3%
IZPFSPT	0.0087	0.0091	+ 5%

An alternative scenario ALT2 is secondary industry-oriented and another alternative scenario ALT3 is primary industry-oriented. In these alternative scenarios, while the input data on the attributes and the scaling constants for the utility functions remain invariant, numerical values of the attributes are changed according to points of view of alternative policy-making.

Illustrations 13 and 14 are examples of using the ADDALT command for setting numerical data for ALT2 and ALT3 respectively.

Illustrations 15 and 16 are examples of numerical evaluations of utility functions for ALT2 and ALT3 using the EVAL command.

As a result, numerical values of multiattribute utility functions in the northern Sensyu area of the Osaka prefecture are shown in Table 7 for the upper three layers of the hierarchical structure. Among the three alternative scenarios, the ALT3 (the primary industry-oriented policy) has highest priority. Among industries, degrees of satisfaction for primary industries are generally high. By examining utility values at lower layers, it is known that satisfaction levels for agriculture are especially high. This is mainly because of high degrees of satisfaction for factor availabilities, in particular for water availabilities. Profitabilities due to high levels of land prices are another reason for the high degrees of satisfaction for agriculture. On the contrary, satisfaction levels of wage revenues especially in local industries are very low. This is a main cause for low degrees of satisfaction in secondary industries.

So far the regional MUFs are assessed and calculated according to the original MUF Structure. And finally an overall regional MUF: SENBOKU is evaluated. Now, industrial MUFs based on each regional assessment are derived. For this purpose, the computer program ICOPSS/I can be utilized effectively to assess a new industry-based MUF Structure.

Illustration 17 shows the calculation process for agriculture. After putting in the MUF name AG and the UNIF name KI, KA, IZ, utility functions for agriculture are assessed at two layers with the UNISET and KSET commands. The linear type of UNIF is

Table 7. Numerical Values of Multiattribute Utility Functions

Attribute	ALT1	ALT2	ALT3
SENBOKU	0.7873	0.7900	0.7983
KI	0.7501	0.7525	0.7691
KIP	0.7998	0.7998	0.8217
KISI	0.2500	0.2702	0.2500
KA	0.8302	0.8331	0.8332
KAP	0.8534	0.8534	0.8572
KASI	0.4518	0.4730	0.4518
IZ	0.7817	0.7844	0.7926
IZP	0.8053	0.8053	0.8168
IZSI	0.3102	0.3595	0.3102

assumed and the option (1) for KSET is chosen. The additive form of MUF is evaluated and listed with the DISPLAY command. With the ADDALT command, current values of the attribute are set. And, with the EVAL command, all the utility values are calculated and listed.

Illustration 18 shows the same procedure for forestry.

Illustration 19 is for fishery.

As a result, it is known that the satisfaction level is the highest for agriculture, second for forest, and the worst for fishery. Thus, with ICOPSS/I, the industrial MUF as well as the regional MUF can be constructed and evaluated effectively.

5. CONCLUDING REMARKS

Computer utilization for decisionmaking processes has a long history in the field of operations research. However, the problem is how to include human judgments into computational processes with proper procedures. Human factors are a subject of evaluations and mechanical elements are objects to which humans make decisions and evaluations. From this point of view, interactive utilizations of a computer system for aiding decisions will be in the most promising direction. Effective ways to operate this installation with minor costs will greatly contribute to improve integrated decisionmaking processes in which a subjective or coordinative phase as well as an analytical one is included.

Hierarchical structuring for multiple objectives is a useful device for depicting and scrutinizing problem structures. Sensitivity analysis will also give assistance to determine which aspects should be mainly examined to improve the present degrees of satisfaction in societies. Along with these devices for better understanding the problem structure, the interactive computer utilization for decision support will display its effectiveness and hopefulness.

Illustration 1

```
* RUN ICOPSS-1#/SAKAWA/SENBOKU"08"

COMMAND:
= INPUT
INPUT MNAME:
= SENBOKU
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 3
INPUT UNAME:
= KI
= KA
= IZ
ANOTHER INPUT?
= YES
INPUT MNAME:
= KI
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 2
INPUT UNAME:
= KIP
= KISI
ANOTHER INPUT?
= YES

INPUT MNAME:
= KA
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 2
INPUT UNAME:
= KAP
= KASI
ANOTHER INPUT?
= YES
INPUT MNAME:
= IZ
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 2
INPUT UNAME:
= IZP
= IZSI
ANOTHER INPUT?
= NO
```

Illustration 2

```
COMMAND:
= STRUCT
INPUT MNAME:
= SENBOKU
STRUCTURE FOR SENBOKU
 ---KI
  !         ----KIP
  !                   ----KIPA
  !                             ----KIPAF
  !                                       ----KIPAFMC
  !         !         !         !         !
  !         !         !         !         !--KIPAFWT
  !                                                 ----KIPAFWTN
  !         !         !         !         !         !
  !         !         !         !         !         !--KIPAFWTV
  !         !         !         !         !         !
  !         !         !         !         !         !--KIPAFWTL
  !         !         !         !         !
  !         !         !         !         !--KIPAFLB
  !         !         !         !
  !         !         !         !--KIPAP
  !                                       ----KIPAPPD
  !         !         !         !         !
  !         !         !         !         !--KIPAPFD
  !         !         !         !         !
  !         !         !         !         !--KIPAPLP
  !                                                 ----KIPAPLPR
  !         !         !         !                   !
  !         !         !         !                   !--KIPAPLPF
  !         !         !         !
  !         !         !         !--KIPAS
  !                                       ----KIPASHA
  !         !         !                   !
  !         !         !                   !--KIPASCL
  !         !         !                   !
  !         !         !                   !--KIPASHN
  !         !         !
  !         !         !--KIPF
  !                             ----KIPFF
  !                                       ----KIPFFLB
  !         !         !         !         !
  !         !         !         !         !--KIPFFFA
  !         !         !         !
  !         !         !         !--KIPFS
  !                                       ----KIPFSCO
  !         !         !                   !
  !         !         !                   !--KIPFSDN
  !         !         !                   !
  !         !         !                   !--KIPFSPT
  !         !
  !         !         !--KIPS
  !                             ----KIPSF
  !                                       ----KIPSFFS
  !         !                   !         !
  !         !                   !         !--KIPSFLB
  !         !                   !
  !         !                   !--KIPSPFO
  !         !                   !
  !         !                   !--KIPSS
  !                                       ----KIPSSCL
  !         !                             !
  !         !                             !--KIPSSNL
  !         !
```

```
!--KISI
          ----KISIL
                    ----KISILTE
                              ----KISILTEL
                              !--KISILTEW
                              !--KISILTEF
                    !--KISILAP
                              ----KISILAPL
                              !--KISILAPW
                              !--KISILAPF
                    !--KISILWO
                              ----KISILWOL
                              !--KISILWOW
                              !--KISILWOF
                    !--KISILCL
                              ----KISILCLL
                              !--KISILCLW
                              !--KISILCLF
          !--KISIN
                    ----KISINSE
                              ----KISINSEL
                              !--KISINSEW
                              !--KISINSEF
                    !--KISINME
                              ----KISINMEL
                              !--KISINMEW
                              !--KISINMEF
                    !--KISINMC
                              ----KISINMCL
                              !--KISINMCW
                              !--MISINMCF
```

```
!--KA
!        ----KAP
!        !        ----KAPA
!        !        !        ----KAPAF
!        !        !        !        ----KAPAFMC
!        !        !        !        !
!        !        !        !        !--KAPAFWT
!        !        !        !        !        ----KAPAFWTN
!        !        !        !        !        !
!        !        !        !        !        !--KAPAFWTV
!        !        !        !        !        !
!        !        !        !        !        !--KAPAFWTL
!        !        !        !        !
!        !        !        !        !--KAPAFLB
!        !        !        !
!        !        !        !--KAPAP
!        !        !        !        ----KAPAPPD
!        !        !        !        !
!        !        !        !        !--KAPAPFD
!        !        !        !        !
!        !        !        !        !--KAPAPLP
!        !        !        !                 ----KAPAPLPR
!        !        !        !                 !
!        !        !        !                 !--KAPAPLPF
!        !        !        !
!        !        !        !--KAPAS
!        !        !                 ----KAPASHA
!        !        !                 !
!        !        !                 !--KAPASCL
!        !        !                 !
!        !        !                 !--KAPASHN
!        !        !
!        !        !--KAPF
!        !        !        ----KAPFF
!        !        !        !        ----KAPFFLB
!        !        !        !        !
!        !        !        !        !--KAPFFFA
!        !        !        !
!        !        !        !--KAPFS
!        !        !                 ----KAPFSCO
!        !        !                 !
!        !        !                 !--KAPFSDN
!        !        !                 !
!        !        !                 !--KAPFSPT
!        !        !
!        !        !--KAPS
!        !                 ----KAPSF
!        !                 !        ----KAPSFFS
!        !                 !        !
!        !                 !        !--KAPSFLB
!        !                 !
!        !                 !--KAPSPFO
!        !                 !
!        !                 !--KAPSS
!        !                          ----KAPSSCL
!        !                          !
!        !                          !--KAPSSNL
!        !
```

```
!          !--KASI
!                    ----KASIL
!                                  ----KASILTE
!                                               ----KASILTEL
!                    !             !            !
!                    !             !            !--KASILTEW
!                    !             !            !
!                    !             !            !--KASILTEF
!                    !             !
!                    !             !--KASILAP
!                                               ----KASILAPL
!                    !             !            !
!                    !             !            !--KASILAPW
!                    !             !            !
!                    !             !            !--KASILAPF
!                    !             !
!                    !             !--KASILWO
!                                               ----KASILWOL
!                    !             !            !
!                    !             !            !--KASILWOW
!                    !             !            !
!                    !             !            !--KASILWOF
!                    !             !
!                    !             !--KASILCL
!                                               ----KASILCLL
!                    !                          !
!                    !                          !--KASILCLW
!                    !                          !
!                    !                          !--KASILCLF
!                    !
!                    !--KASIN
!                                  ----KASINSE
!                                               ----KASINSEL
!                                  !            !
!                                  !            !--KASINSEW
!                                  !            !
!                                  !            !--KASINSEF
!                                  !
!                                  !--KASINME
!                                               ----KASINMEL
!                                  !            !
!                                  !            !--KASINMEW
!                                  !            !
!                                  !            !--KASINMEF
!                                  !
!                                  !--KASINMC
!                                               ----KASINMCL
!                                               !
!                                               !--KASINMCW
!                                               !
!                                               !--KASINMCF
!
```

```
!--IZ
    ----IZP
        ----IZPA
            ----IZPAF
                ----IZPAFMC
                !
                !--IZPAFWT
                    ----IZPAFWTN
                    !
                    !--IZPAFWTV
                    !
                    !--IZPAFWTL
                !
                !--IZPAFLB
            !
            !--IZPAP
                ----IZPAPPD
                !
                !--IZPAPFD
                !
                !--IZPAPLP
                    ----IZPAPLPR
                    !
                    !--IZPAPLPF
            !
            !--IZPAS
                ----IZPASHA
                !
                !--IZPASCL
                !
                !--IZPASHN
        !
        !--IZPF
            ----IZPFF
                ----IZPFFLB
                !
                !--IZPFFFA
            !
            !--IZPFS
                ----IZPFSCO
                !
                !--IZPFSDN
                !
                !--IZPFSPT
    !
```

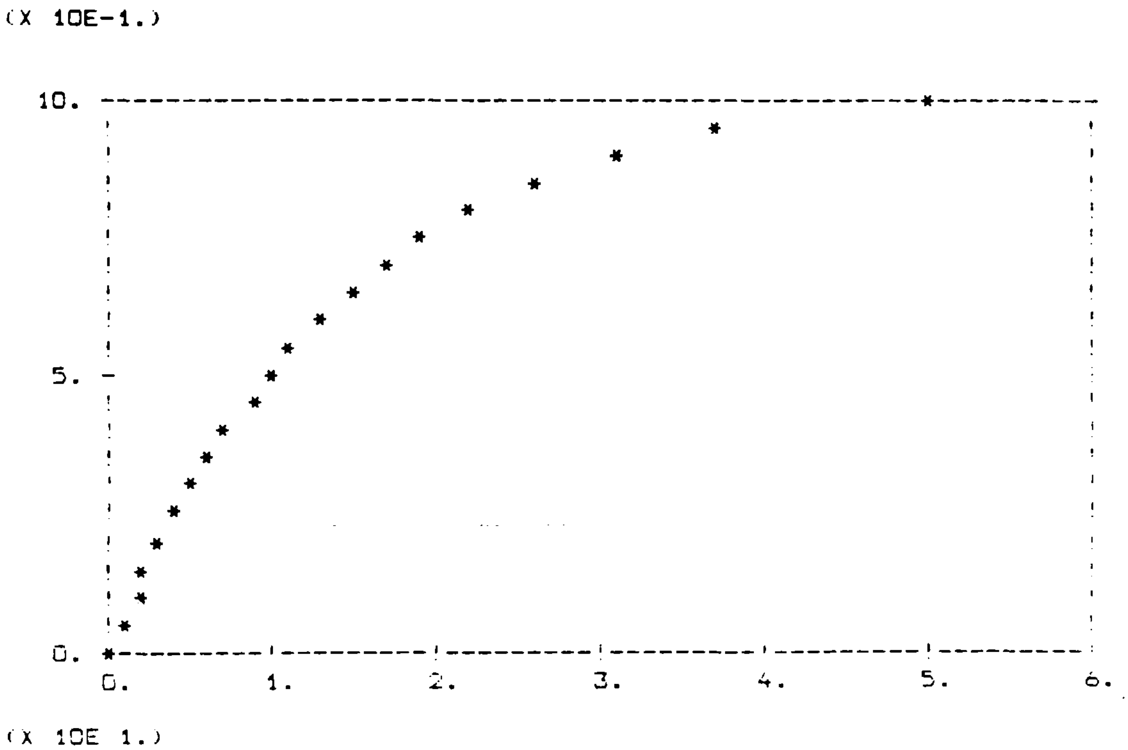
```
!--IZSI
      ----IZSIL
      !        ----IZSILTE
      !        !         ----IZSILTEL
      !        !         !
      !        !         !--IZSILTEW
      !        !         !
      !        !         !--IZSILTEF
      !        !
      !        !--IZSILAP
      !        !         ----IZSILAPL
      !        !         !
      !        !         !--IZSILAPW
      !        !         !
      !        !         !--IZSILAPF
      !        !
      !        !--IZSILWO
      !        !         ----IZSILWOL
      !        !         !
      !        !         !--IZSILWOW
      !        !         !
      !        !         !--IZSILWOF
      !        !
      !        !--IZSILCL
      !                  ----IZSILCLL
      !                  !
      !                  !--IZSILCLW
      !                  !
      !                  !--IZSILCLF
      !
      !--IZSIN
               ----IZSINCH
               !
               !         ----IZSINCHL
               !         !
               !         !--IZSINCHW
               !         !
               !         !--IZSINCHF
               !
               !--IZSINSE
               !         ----IZSINSEL
               !         !
               !         !--IZSINSEW
               !         !
               !         !--IZSINSEF
               !
               !--IZSINME
               !         ----IZSINMEL
               !         !
               !         !--IZSINMEW
               !         !
               !         !--IZSINMEF
               !
               !--IZSINMC
               !         ----IZSINMCL
               !         !
               !         !--IZSINMCW
               !         !
               !         !--IZSINMCF
               !
               !--IZSINNM
                         ----IZSINNML
                         !
                         !--IZSINNMW
                         !
                         !--IZSINNMF
```

Illustration 3

```
COMMAND:
= UNISET
INPUT UNIF NAME:
= IZPAFWTN
WANT LIST OF UNIF TYPE?
= YES
LIST OF UNIF TYPE
 (1) LINEAR
 (2) PIECEWISE LINEAR
 (3) CONSTANT RISK
 (4) DECREASING RISK AVERSE
 (5) INCREASING RISK PRONE
INPUT UNIF TYPE:
= 3
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 50.0
INPUT 50-50 LOTTERY(WORSE PAYOFF,BETTER PAYOFF & C.E.):
= 0.0 50.0 10.0
ANOTHER UNISET?
= YES
INPUT UNIF NAME:
= IZPAFWTV
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 4
WILL YOU SPECIFY (1) POINT ON CURVE
              OR (2) DESCRIPTIONS OF LOTTERIES?
= 1
INPUT ATTRIBUTE VALUES FOR U = 0, .25, .5, .75, 1:
= 0.0 25.0 80.0 190.0 500.0
FUNCTION EVERYWHERE RISK AVERSE.
ANOTHER UNISET?
= YES
INPUT UNIF NAME:
= IZPAFWTL
WANT LIST OF UNIF TYPE?
= NO

INPUT UNIF TYPE:
= 3
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 5000.0
INPUT 50-50 LOTTERY(WORSE PAYOFF,BETTER PAYOFF & C.E.):
= 0.0 5000.0 2000.0
ANOTHER UNISET?
= NO
```

Illustration 4

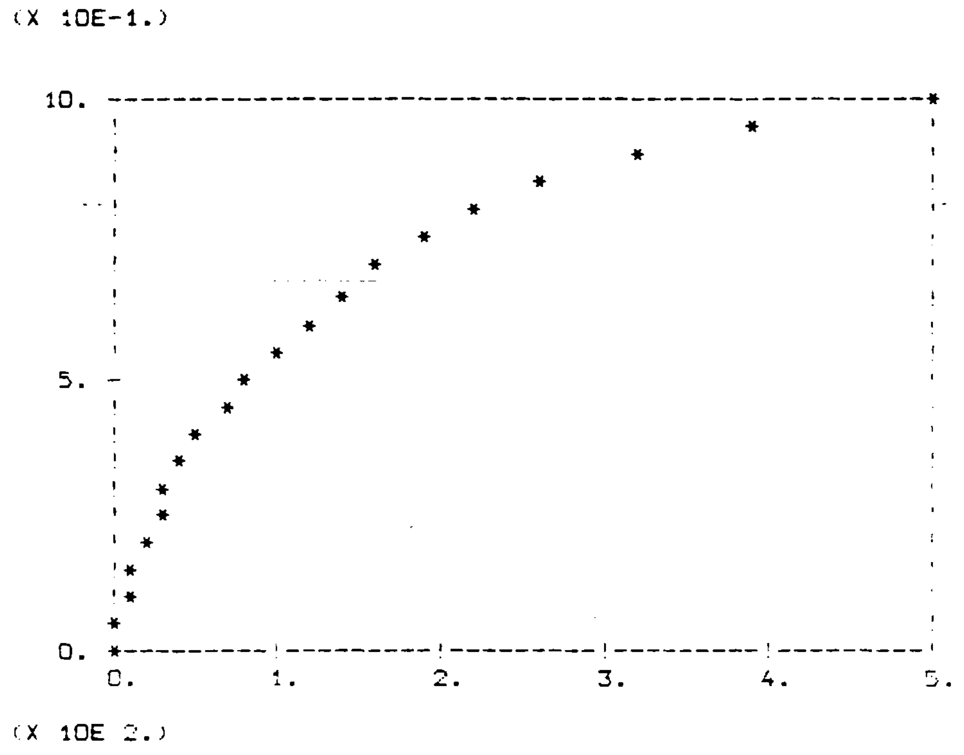
```
COMMAND:
= GRAPHU
INPUT UNIF NAME:
= IZPAFWTN

IZPAFWTN
 UNIF TYPE --- CONSTANT RISK

 ************************************************************************
```




```
 ########################################################################
```

```
COMMAND:
= GRAPHU
INPUT UNIF NAME:
= IZPAFWTV

IZPAFWTV
 UNIF TYPE --- DECREASING RISK AVERSE
```

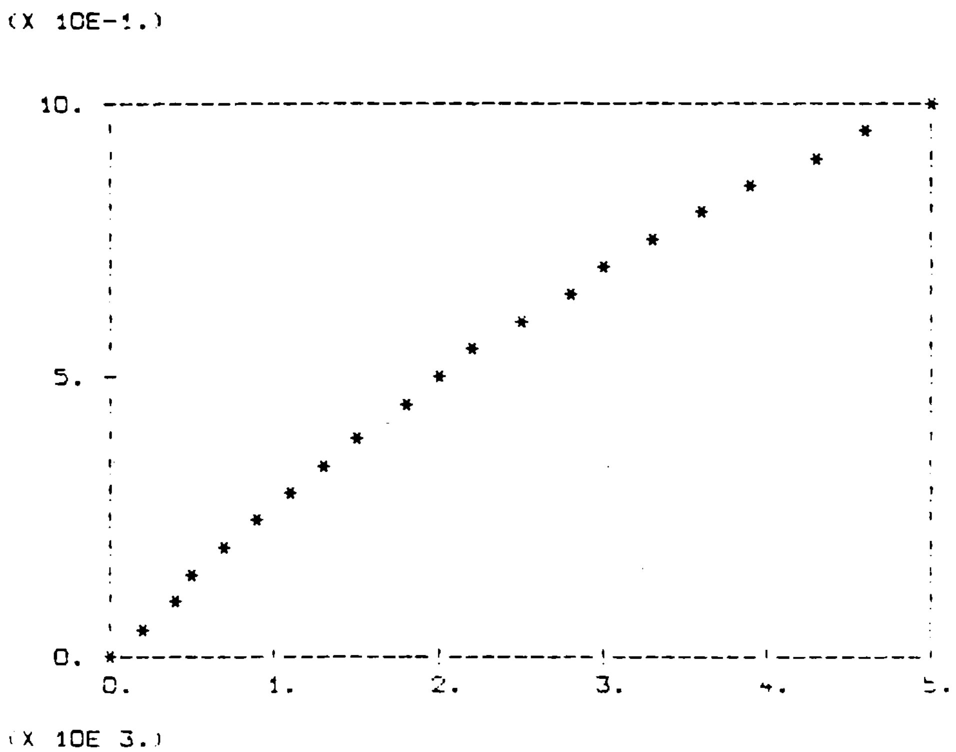
****



##

```
COMMAND:
= GRAPHU
INPUT UNIF NAME:
= IZPAFWTL

IZPAFWTL
 UNIF TYPE --- CONSTANT RISK
```

****



##

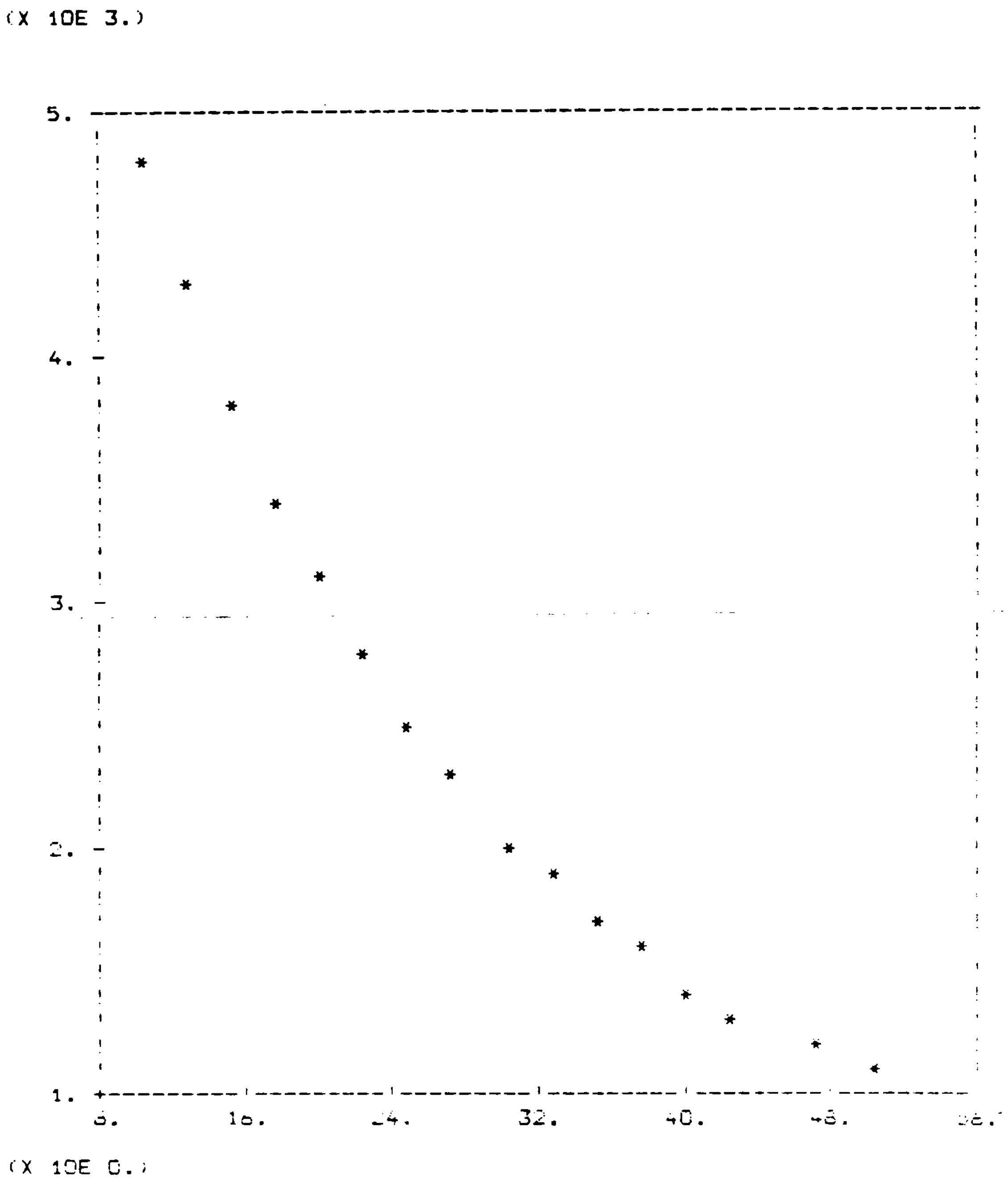
Illustration 5

```
COMMAND:
= KSET
INPUT MNAME:
= IZPAFWT
WANT LIST OF THE METHOD FOR KSET?
= YES
LIST OF THE METHOD FOR KSET
 (1) BY INPUT OF K'S VALUES DIRECTRY
 (2) BY INDIFFERENCE PAIRS AND LOTTERY
 (3) BY INDIFFRENCE PAIRS
WHICH METHOD DO YOU USE?
= 2
INPUT REFERENCE UNAME:
= IZPAFWTV
INPUT THE FOLLOWING ANS1 AND ANS2:
( IZPAFWTV , IZPAFWTN ) = ( ANS1           ,        0.        )
        IS INDIFFERENT TO (       0.       , ANS2             )
(INPUT ATTRIBUTE VALUES)
= 200.0 50.0
( IZPAFWTV , IZPAFWTL ) = ( ANS1           ,        0.        )
        IS INDIFFERENT TO (       0.       , ANS2             )
(INPUT ATTRIBUTE VALUES)
= 150.0 5000.0
INPUT P SUCH THAT
     LOTTERY --- ALL ARE BEST WITH PROBABILITY P
              !- ALL ARE WORST WITH PROBABILITY 1-P
AND
     CERTAINTY CONSEQUENCE --- IZPAFWTV IS BEST
                            !- THE OTHERS ARE WORST
ARE INDIFFERENT:
= 0.8
K( IZPAFWTN ) =    0.6128
K( IZPAFWTV ) =    0.8000
K( IZPAFWTL ) =    0.5415
* CAPITAL K =   -0.95312
ANOTHER KSET?
= NO
```

Illustration 6

```
COMMAND:
= GRAPHI
INPUT UNAME1 AND UNAME2:
= IZPAFWTN
= IZPAFWTL
INPUT INDIFFERENCE POINT THROUGH WHICH CURVE WILL PASS:
(ATTRIBUTE VALUES)
= 25.0 2500.0
INDIFFERENCE CURVE
        (X-AXIS) --- IZPAFWTN          (Y-AXIS) --- IZPAFWTL
```

****



###

```
COMMAND:
= GRAPHI
INPUT UNAME1 AND UNAME2:
= IZPAFWTV
= IZPAFWTN
INPUT INDIFFERENCE POINT THROUGH WHICH CURVE WILL PASS:
(ATTRIBUTE VALUES)
= 250.0 25.0
INDIFFERENCE CURVE
        (X-AXIS) --- IZPAFWTV          (Y-AXIS) --- IZPAFWTN
```

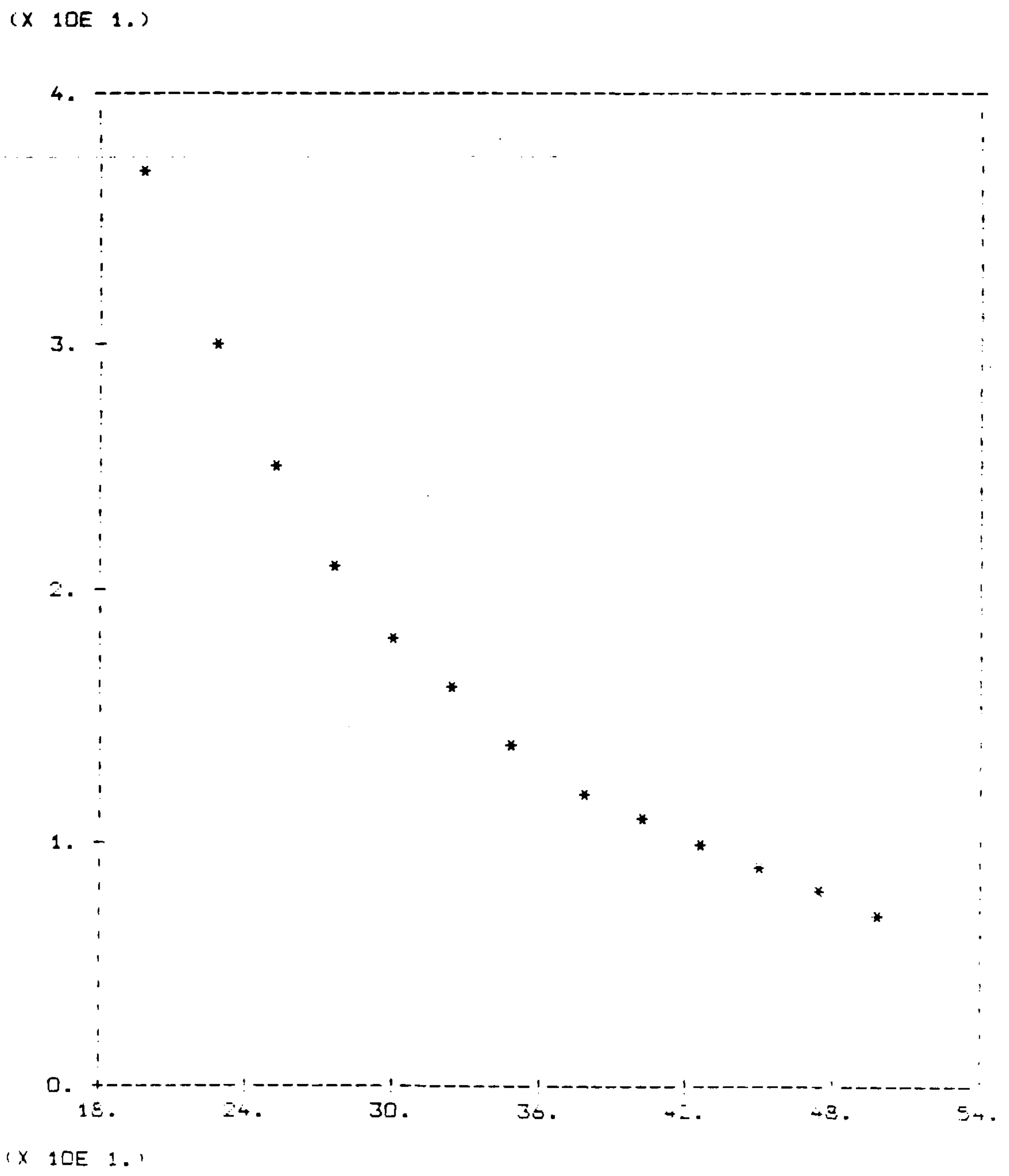


Illustration 7

```
COMMAND:
= IMAP
INPUT UNAME1 AND UNAME2:
= IZPAFWTV
= IZPAFWTN
INPUT INDIFFERENCE POINT THROUGH WHICH CURVE WILL PASS:
(ATTRIBUTE VALUES)
= 250.0 25.0
INPUT NUMBER OF POINTS FOR MAP:
= 7
INPUT ATTRIBUTE VALUES OF IZPAFWTV FOR MAP:
= 200.0 250.0 300.0 350.0 400.0 450.0 500.0
INDIFFERENCE POINTS
(     200.00000 ,       36.96078 )
(     250.00000 ,       24.99999 )
(     300.00000 ,       18.45715 )
(     350.00000 ,       14.08005 )
(     400.00000 ,       10.92089 )
(     450.00000 ,        8.55908 )
(     500.00000 ,        6.76245 )

COMMAND:
= IMAP
INPUT UNAME1 AND UNAME2:
= IZPAFWTN
= IZPAFWTL
INPUT INDIFFERENCE POINT THROUGH WHICH CURVE WILL PASS:
(ATTRIBUTE VALUES)
= 25.0 2500.0
INPUT NUMBER OF POINTS FOR MAP:
= 9
INPUT ATTRIBUTE VALUES OF IZPAFWTN FOR MAP:
= 10.0 15.0 20.0 25.0 30.0 35.0 40.0 45.0 50.0
INDIFFERENCE POINTS
(      10.00000 ,    4798.30176 )
(      15.00000 ,    3848.68436 )
(      20.00000 ,    3092.09952 )
(      25.00000 ,    2499.99960 )
(      30.00000 ,    2044.30185 )
(      35.00000 ,    1698.66455 )
(      40.00000 ,    1439.67279 )
(      45.00000 ,    1247.48672 )
(      50.00000 ,    1105.95544 )

COMMAND:
= IMAP
INPUT UNAME1 AND UNAME2:
= IZPAFWTV
= IZPAFWTL
INPUT INDIFFERENCE POINT THROUGH WHICH CURVE WILL PASS:
(ATTRIBUTE VALUES)
= 250.0 2500.0
INPUT NUMBER OF POINTS FOR MAP:
= 7
INPUT ATTRIBUTE VALUES OF IZPAFWTV FOR MAP:
= 150.0 200.0 250.0 300.0 350.0 400.0 450.0
INDIFFERENCE POINTS
(     150.00000 ,    4501.00391 )
(     200.00000 ,    3428.08075 )
(     250.00000 ,    2499.99960 )
(     300.00000 ,    1705.45306 )
(     350.00000 ,    1033.93881 )
(     400.00000 ,     473.90424 )
(     450.00000 ,      12.78957 )
```

Illustration 8

```
COMMAND:
= READ
DATA IS READ.

COMMAND:
= DEBUG
DEBUG FOR SENBOKU
(LEVEL  1)
KI          (MUF)      K =     0.3333
KA          (MUF)      K =     0.3333
IZ          (MUF)      K =     0.3333
(LEVEL  2)
KIP         (MUF)      K =     0.9000
KISI        (MUF)      K =     0.2070
KAP         (MUF)      K =     0.9000
KASI        (MUF)      K =     0.3600
IZP         (MUF)      K =     0.9500
IZSI        (MUF)      K =     0.0665
(LEVEL  3)
KIPA        (MUF)      K =     0.9000
KIPF        (MUF)      K =     0.1125
KIPS        (MUF)      K =     0.1350

KISIL       (MUF)      K =     0.8500
KISIN       (MUF)      K =     0.1020
KAPA        (MUF)      K =     0.9000
KAPF        (MUF)      K =     0.4500
KAPS        (MUF)      K =     0.3600
KASIL       (MUF)      K =     0.9000
KASIN       (MUF)      K =     0.1350
IZPA        (MUF)      K =     0.4250
IZPF        (MUF)      K =     0.8500
IZSIL       (MUF)      K =     0.9000
IZSIN       (MUF)      K =     0.0630
```

```
(LEVEL  4)
KIPAF      (MUF)     K =   0.9000
KIPAP      (MUF)     K =   0.1350
KIPAS      (MUF)     K =   0.2070
KIPFF      (MUF)     K =   0.3400
KIPFS      (MUF)     K =   0.8500
KIPSF      (MUF)     K =   0.4655
KIPSPFO    (UNIF)    K =   0.9500
  RANGE (       0.       ---   1000.00000 )  TYPE-4
KIPSS      (MUF)     K =   0.5035
KISILTE    (MUF)     K =   0.9000
KISILAP    (MUF)     K =   0.1080

KISILWO    (MUF)     K =   0.0900
KISILCL    (MUF)     K =   0.0540
KISINSE    (MUF)     K =   0.1440
KISINME    (MUF)     K =   0.9000
KISINMC    (MUF)     K =   0.1800
KAPAF      (MUF)     K =   0.4860
KAPAP      (MUF)     K =   0.3600
KAPAS      (MUF)     K =   0.9000
KAPFF      (MUF)     K =   0.3690
KAPFS      (MUF)     K =   0.9000
KAPSF      (MUF)     K =   0.2960
KAPSPFO    (UNIF)    K =   0.3760
  RANGE (       0.       ---   1000.00000 )  TYPE-4
KAPSS      (MUF)     K =   0.8000
KASILTE    (MUF)     K =   0.3150
KASILAP    (MUF)     K =   0.9000
KASILWO    (MUF)     K =   0.3600
KASILCL    (MUF)     K =   0.1800
KASINSE    (MUF)     K =   0.1080
KASINME    (MUF)     K =   0.9000
KASINMC    (MUF)     K =   0.1350
IZPAF      (MUF)     K =   0.8500
IZPAP      (MUF)     K =   0.1700

IZPAS      (MUF)     K =   0.2635
IZPFF      (MUF)     K =   0.4750
IZPFS      (MUF)     K =   0.9500
IZSILTE    (MUF)     K =   0.2070
IZSILAP    (MUF)     K =   0.0990
IZSILWO    (MUF)     K =   0.9000
IZSILCL    (MUF)     K =   0.1350
IZSINCH    (MUF)     K =   0.0900
IZSINSE    (MUF)     K =   0.0450
IZSINME    (MUF)     K =   0.9000
IZSINMC    (MUF)     K =   0.1800
IZSINNM    (MUF)     K =   0.0225
```

```
(LEVEL  5)
KIPAFMC    (UNIF)     K =   0.2218
  RANGE (        0.        ---         3.00000 )   TYPE-3
KIPAFWT    (MUF)      K =   0.3325
KIPAFLB    (UNIF)     K =   0.9500
  RANGE (        0.        ---        10.00000 )   TYPE-3
KIPAPPD    (UNIF)     K =   0.2955
  RANGE (        0.        ---         8.00000 )   TYPE-4
KIPAPFD    (UNIF)     K =   0.9000
  RANGE (        0.        ---         6.00000 )   TYPE-3
KIPAPLP    (MUF)      K =   0.2700

KIPASHA    (UNIF)     K =   0.9500
  RANGE (        0.        ---         5.00000 )   TYPE-4
KIPASCL    (UNIF)     K =   0.5350
  RANGE (        0.        ---        30.00000 )   TYPE-4
KIPASHN    (UNIF)     K =   0.3690
  RANGE (        0.        ---         2.00000 )   TYPE-4
KIPFFLB    (UNIF)     K =   0.8000
  RANGE (        0.        ---         1.00000 )   TYPE-4
KIPFFFA    (UNIF)     K =   0.4000
  RANGE (        0.        ---        10.00000 )   TYPE-1
KIPFSCO    (UNIF)     K =   0.9000
  RANGE (        0.        ---         0.90000 )   TYPE-4
KIPFSDN    (UNIF)     K =   0.3400
  RANGE (        0.        ---       200.00000 )   TYPE-4
KIPFSPT    (UNIF)     K =   0.2105
  RANGE (        0.        ---         0.05000 )   TYPE-4
KIPSFFS    (UNIF)     K =   0.0163
  RANGE (        0.        ---        10.00000 )   TYPE-4
KIPSFLB    (UNIF)     K =   0.9500
  RANGE (        0.        ---        10.00000 )   TYPE-3
KIPSSCL    (UNIF)     K =   0.8000
  RANGE (        0.        ---         2.00000 )   TYPE-4
KIPSSNL    (UNIF)     K =   0.2985

  RANGE (        0.        ---         2.00000 )   TYPE-4
KISILTEL   (UNIF)     K =   0.0251
  RANGE (        0.        ---        20.00000 )   TYPE-1
KISILTEW   (UNIF)     K =   0.9000
  RANGE (        0.        ---         6.00000 )   TYPE-3
KISILTEF   (UNIF)     K =   0.0894
  RANGE (        0.        ---       100.00000 )   TYPE-1
KISILAPL   (UNIF)     K =   0.0237
  RANGE (        0.        ---        20.00000 )   TYPE-1
KISILAPW   (UNIF)     K =   0.8500
  RANGE (        0.        ---         6.00000 )   TYPE-3
KISILAPF   (UNIF)     K =   0.0488
  RANGE (        0.        ---       100.00000 )   TYPE-1
KISILWOL   (UNIF)     K =   0.8000
  RANGE (        0.        ---        30.00000 )   TYPE-3
KISILWOW   (UNIF)     K =   0.3700
  RANGE (        0.        ---         6.00000 )   TYPE-3
KISILWOF   (UNIF)     K =   0.1259
  RANGE (        0.        ---       300.00000 )   TYPE-3
KISILCLL   (UNIF)     K =   0.8000
  RANGE (        0.        ---        30.00000 )   TYPE-3
KISILCLW   (UNIF)     K =   0.2901
  RANGE (        0.        ---         6.00000 )   TYPE-3
```

```
KISILCLF   (UNIF)     K =   0.2023
  RANGE (       0.         ---     300.00000 )  TYPE-3
KISINSEL   (UNIF)     K =   0.2745
  RANGE (       0.         ---      30.00000 )  TYPE-4
KISINSEW   (UNIF)     K =   0.8500
  RANGE (       0.         ---       6.00000 )  TYPE-4
KISINSEF   (UNIF)     K =   0.2293
  RANGE (       0.         ---     700.00000 )  TYPE-4
KISINMEL   (UNIF)     K =   0.0567
  RANGE (       0.         ---      20.00000 )  TYPE-1
KISINMEW   (UNIF)     K =   0.8500
  RANGE (       0.         ---       6.00000 )  TYPE-1
KISINMEF   (UNIF)     K =   0.1133
  RANGE (       0.         ---     200.00000 )  TYPE-3
KISINMCL   (UNIF)     K =   0.9500
  RANGE (       0.         ---      20.00000 )  TYPE-1
KISINMCW   (UNIF)     K =   0.0475
  RANGE (       0.         ---       6.00000 )  TYPE-3
KISINMCF   (UNIF)     K =   0.0950
  RANGE (       0.         ---     100.00000 )  TYPE-1
KAPAFMC    (UNIF)     K =   0.2295
  RANGE (       0.         ---       3.00000 )  TYPE-3
KAPAFWT    (MUF)      K =   0.8500

KAPAFLB    (UNIF)     K =   0.3400
  RANGE (       0.         ---      10.00000 )  TYPE-3
KAPAPPD    (UNIF)     K =   0.3371
  RANGE (       0.         ---       8.00000 )  TYPE-4
KAPAPFD    (UNIF)     K =   0.8500
  RANGE (       0.         ---       6.00000 )  TYPE-3
KAPAPLP    (MUF)      K =   0.2975
KAPASHA    (UNIF)     K =   0.9500
  RANGE (       0.         ---       5.00000 )  TYPE-4
KAPASCL    (UNIF)     K =   0.3690
  RANGE (       0.         ---      30.00000 )  TYPE-4
KAPASHN    (UNIF)     K =   0.2249
  RANGE (       0.         ---       2.00000 )  TYPE-4
KAPFFLB    (UNIF)     K =   0.1800
  RANGE (       0.         ---       1.00000 )  TYPE-4
KAPFFFA    (UNIF)     K =   0.9000
  RANGE (       0.         ---      10.00000 )  TYPE-1
KAPFSCO    (UNIF)     K =   0.9500
  RANGE (       0.         ---       0.90000 )  TYPE-4
KAPFSDN    (UNIF)     K =   0.1535
  RANGE (       0.         ---     200.00000 )  TYPE-4
KAPFSPT    (UNIF)     K =   0.2222
  RANGE (       0.         ---       0.05000 )  TYPE-4

KAPSFFS    (UNIF)     K =   0.2552
  RANGE (       0.         ---      10.00000 )  TYPE-4
KAPSFLB    (UNIF)     K =   0.9000
  RANGE (       0.         ---      10.00000 )  TYPE-3
KAPSSCL    (UNIF)     K =   0.7500
  RANGE (       0.         ---       2.00000 )  TYPE-4
KAPSSNL    (UNIF)     K =   0.3922
```

```
    RANGE (        0.         ---        2.00000 )   TYPE-4
  KASILTEL   (UNIF)     K =    0.0433
    RANGE (        0.         ---       20.00000 )   TYPE-1
  KASILTEW   (UNIF)     K =    0.8698
    RANGE (        0.         ---        6.00000 )   TYPE-1
  KASILTEF   (UNIF)     K =    0.0868
    RANGE (        0.         ---      200.00000 )   TYPE-3
  KASILAPL   (UNIF)     K =    0.9000
    RANGE (        0.         ---       20.00000 )   TYPE-1
  KASILAPW   (UNIF)     K =    0.1665
    RANGE (        0.         ---        6.00000 )   TYPE-3
  KASILAPF   (UNIF)     K =    0.0900
    RANGE (        0.         ---      100.00000 )   TYPE-1
  KASILWOL   (UNIF)     K =    0.8500
    RANGE (        0.         ---       20.00000 )   TYPE-1
  KASILWOW   (UNIF)     K =    0.1275

    RANGE (        0.         ---        6.00000 )   TYPE-3
  KASILWOF   (UNIF)     K =    0.2550
    RANGE (        0.         ---      100.00000 )   TYPE-1
  KASILCLL   (UNIF)     K =    0.1954
    RANGE (        0.         ---       30.00000 )   TYPE-3
  KASILCLW   (UNIF)     K =    0.9000
    RANGE (        0.         ---        6.00000 )   TYPE-3
  KASILCLF   (UNIF)     K =    0.1199
    RANGE (        0.         ---      300.00000 )   TYPE-3
  KASINSEL   (UNIF)     K =    0.1199
    RANGE (        0.         ---       30.00000 )   TYPE-3
  KASINSEW   (UNIF)     K =    0.9000
    RANGE (        0.         ---        6.00000 )   TYPE-3
  KASINSEF   (UNIF)     K =    0.1954
    RANGE (        0.         ---      300.00000 )   TYPE-3
  KASINMEL   (UNIF)     K =    0.0894
    RANGE (        0.         ---       20.00000 )   TYPE-1
  KASINMEW   (UNIF)     K =    0.9000
    RANGE (        0.         ---        6.00000 )   TYPE-3
  KASINMEF   (UNIF)     K =    0.1094
    RANGE (        0.         ---      100.00000 )   TYPE-1
  KASINMCL   (UNIF)     K =    0.9000
    RANGE (        0.         ---       20.00000 )   TYPE-1

  KASINMCW   (UNIF)     K =    0.0900
    RANGE (        0.         ---        6.00000 )   TYPE-3
  KASINMCF   (UNIF)     K =    0.1350
```

```
  RANGE (       0.        ---    100.00000 )   TYPE-1
IZPAFMC    (UNIF)     K =    0.8000
  RANGE (       0.        ---      3.00000 )   TYPE-3
IZPAFWT    (MUF)      K =    0.3600
IZPAFLB    (UNIF)     K =    0.2534
  RANGE (       0.        ---     10.00000 )   TYPE-3
IZPAPPD    (UNIF)     K =    0.2659
  RANGE (       0.        ---      8.00000 )   TYPE-4
IZPAPFD    (UNIF)     K =    0.9500
  RANGE (       0.        ---      6.00000 )   TYPE-3
IZPAPLP    (MUF)      K =    0.1330
IZPASHA    (UNIF)     K =    0.9000
  RANGE (       0.        ---      5.00000 )   TYPE-4
IZPASCL    (UNIF)     K =    0.5069
  RANGE (       0.        ---     30.00000 )   TYPE-4
IZPASHN    (UNIF)     K =    0.3496
  RANGE (       0.        ---      2.00000 )   TYPE-4
IZPFFLB    (UNIF)     K =    0.7000
  RANGE (       0.        ---      1.00000 )   TYPE-4
IZPFFFA    (UNIF)     K =    0.3685

  RANGE (       0.        ---     10.00000 )   TYPE-1
IZPFSCO    (UNIF)     K =    0.4750
  RANGE (       0.        ---      0.90000 )   TYPE-4
IZPFSDN    (UNIF)     K =    0.3197
  RANGE (       0.        ---    200.00000 )   TYPE-4
IZPFSPT    (UNIF)     K =    0.9500
  RANGE (       0.        ---      0.05000 )   TYPE-4
IZSILTEL   (UNIF)     K =    0.1700
  RANGE (       0.        ---     20.00000 )   TYPE-1
IZSILTEW   (UNIF)     K =    0.5100
  RANGE (       0.        ---      6.00000 )   TYPE-3
IZSILTEF   (UNIF)     K =    0.8500
  RANGE (       0.        ---    100.00000 )   TYPE-1
IZSILAPL   (UNIF)     K =    0.8500
  RANGE (       0.        ---     20.00000 )   TYPE-1
IZSILAPW   (UNIF)     K =    0.1700
  RANGE (       0.        ---      6.00000 )   TYPE-3
IZSILAPF   (UNIF)     K =    0.0850
  RANGE (       0.        ---    100.00000 )   TYPE-1
IZSILWOL   (UNIF)     K =    0.9000
  RANGE (       0.        ---     20.00000 )   TYPE-3
IZSILWOW   (UNIF)     K =    0.0660
  RANGE (       0.        ---      6.00000 )   TYPE-5

IZSILWOF   (UNIF)     K =    0.1364
  RANGE (       0.        ---     20.00000 )   TYPE-3
IZSILCLL   (UNIF)     K =    0.0265
  RANGE (       0.        ---     20.00000 )   TYPE-1
IZSILCLW   (UNIF)     K =    0.9500
  RANGE (       0.        ---      6.00000 )   TYPE-3
IZSILCLF   (UNIF)     K =    0.0545
  RANGE (       0.        ---    100.00000 )   TYPE-1
IZSINCHL   (UNIF)     K =    0.0968
  RANGE (       0.        ---     30.00000 )   TYPE-4
IZSINCHW   (UNIF)     K =    0.8500
  RANGE (       0.        ---      6.00000 )   TYPE-4
IZSINCHF   (UNIF)     K =    0.2293
  RANGE (       0.        ---    700.00000 )   TYPE-4
```

```
IZSINSEL   (UNIF)      K =   0.1259
  RANGE (        0.         ---        30.00000 )   TYPE-4
IZSINSEW   (UNIF)      K =   0.8500
  RANGE (        0.         ---         6.00000 )   TYPE-4
IZSINSEF   (UNIF)      K =   0.1800
  RANGE (        0.         ---       700.00000 )   TYPE-4
IZSINMEL   (UNIF)      K =   0.8500
  RANGE (        0.         ---        20.00000 )   TYPE-1
IZSINMEW   (UNIF)      K =   0.0850

  RANGE (        0.         ---         6.00000 )   TYPE-3
IZSINMEF   (UNIF)      K =   0.1700
  RANGE (        0.         ---       100.00000 )   TYPE-1
IZSINMCL   (UNIF)      K =   0.8500
  RANGE (        0.         ---        20.00000 )   TYPE-1
IZSINMCW   (UNIF)      K =   0.1700
  RANGE (        0.         ---         6.00000 )   TYPE-3
IZSINMCF   (UNIF)      K =   0.2125
  RANGE (        0.         ---       100.00000 )   TYPE-1
IZSINNML   (UNIF)      K =   0.8500
  RANGE (        0.         ---        30.00000 )   TYPE-4
IZSINNMW   (UNIF)      K =   0.2725
  RANGE (        0.         ---         6.00000 )   TYPE-4
IZSINNMF   (UNIF)      K =   0.1897
  RANGE (        0.         ---       700.00000 )   TYPE-4
(LEVEL  6)
KIPAFWTN   (UNIF)      K =   0.9000
  RANGE (        0.         ---        50.00000 )   TYPE-3
KIPAFWTV   (UNIF)      K =   0.6835
  RANGE (        0.         ---       500.00000 )   TYPE-4
KIPAFWTL   (UNIF)      K =   0.4500
  RANGE (        0.         ---      5000.00000 )   TYPE-3
KIPAPLPR   (UNIF)      K =   0.9000

  RANGE (        0.         ---        30.00000 )   TYPE-4
KIPAPLPF   (UNIF)      K =   0.7541
  RANGE (        0.         ---        30.00000 )   TYPE-4
KAPAFWTN   (UNIF)      K =   0.4500
  RANGE (        0.         ---        50.00000 )   TYPE-3
KAPAFWTV   (UNIF)      K =   0.3510
  RANGE (        0.         ---       500.00000 )   TYPE-4
KAPAFWTL   (UNIF)      K =   0.9000
  RANGE (        0.         ---      5000.00000 )   TYPE-3
KAPAPLPR   (UNIF)      K =   0.9000
  RANGE (        0.         ---        30.00000 )   TYPE-4
KAPAPLPF   (UNIF)      K =   0.7541
  RANGE (        0.         ---        30.00000 )   TYPE-4
IZPAFWTN   (UNIF)      K =   0.6128
  RANGE (        0.         ---        50.00000 )   TYPE-3
IZPAFWTV   (UNIF)      K =   0.8000
  RANGE (        0.         ---       500.00000 )   TYPE-4
IZPAFWTL   (UNIF)      K =   0.5415
  RANGE (        0.         ---      5000.00000 )   TYPE-3
IZPAPLPR   (UNIF)      K =   0.9000
  RANGE (        0.         ---        30.00000 )   TYPE-4
IZPAPLPF   (UNIF)      K =   0.7541
  RANGE (        0.         ---        30.00000 )   TYPE-4
```

Illustration 9

```
COMMAND:
= DISPLAY
INPUT UTIL NAME:
= IZPAFWT
(MUF)
IZPAFWT ----IZPAFWTN    ( K =   0.6128 )
           !
           !--IZPAFWTV    ( K =   0.8000 )
           !
           !--IZPAFWTL    ( K =   0.5415 )
  CAPITAL K =   -0.95312

COMMAND:
= DISPLAY
INPUT UTIL NAME:
= IZPAFWTN
(UNIF)
RANGE (        0.       ---      50.00000 )
UNIF TYPE --- CONSTANT RISK
   U(X) = A+B*EXP(-C*X)
     A =        1.03904748
     B =       -1.03904748
     C =        0.06562560

COMMAND:
= DISPLAY
INPUT UTIL NAME:
= IZPAFWTV
(UNIF)
RANGE (        0.       ---     500.00000 )
UNIF TYPE --- DECREASING RISK AVERSE
   U(X) = A*EXP(-B*X)+C*EXP(-D*X)+E
     A =       -0.21404888
     B =        0.04545373
     C =       -0.84634700
     D =        0.00528002
     E =        1.06039584

COMMAND:
= DISPLAY
INPUT UTIL NAME:
= IZPAFWTL
(UNIF)
RANGE (        0.       ---    5000.00000 )
UNIF TYPE --- CONSTANT RISK
   U(X) = A+B*EXP(-C*X)
     A =        1.78405739
     B =       -1.78405739
     C =        0.00016443
```

Illustration 10

```
COMMAND:
= ADDALT
INPUT ALT NAME:
= ALT1
WANT LIST OF ALT TYPE?
= YES
LIST OF ALT TYPE
 (1) CERTAINTY
 (2) PROBABILITY : DISCRETE DISTRIBUTION
 (3) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE LINEAR)
 (4) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE QUADRATIC)
KIPAFMC ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.50

KIPAFWTN---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 39.47
KIPAFWTV---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 145.19
KIPAFWTL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3229.6
KIPAFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 5.58
KIPAPPD ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3.53
KIPAPFD ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:

= 1.41
KIPAPLPR---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.93
KIPAPLPF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 5.43
KIPASHA ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.40
KIPASCL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 19.0
KIPASHN ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.85
```

```
KIPFFLB ---INPUT ALT TYPE:
= 1

INPUT VALUE OF THE ATTRIBUTE:
= 0.164
KIPFFFA ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.75
KIPFSCO ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.27
KIPFSDN ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 95.24
KIPFSPT ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.0033
KIPSFFS ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.98
KIPSFLB ---INPUT ALT TYPE:

= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3.5
KIPSPFO ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 289.5
KIPSSCL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.93
KIPSSNL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.75
```

```
KISILTEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 8.4
KISILTEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.29

KISILTEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 23.6
KISILAPL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.8
KISILAPW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.18
KISILAPF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 24.6
KISILWOL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 12.90
KISILWOW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:

= 1.93
KISILWOF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 136.6
KISILCLL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 13.2
KISILCLW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.03
KISILCLF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 177.5
```

```
KISINSEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 16.7
KISINSEW---INPUT ALT TYPE:
= 1

INPUT VALUE OF THE ATTRIBUTE:
= 2.73
KISINSEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 225.2
KISINMEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 13.4
KISINMEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.34
KISINMEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 92.1
KISINMCL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 7.6
KISINMCW---INPUT ALT TYPE:

= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.07
KISINMCF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 42.2
```

Illustration 11

```
COMMAND:
= READ
DATA IS READ.

COMMAND:
= EVAL
INPUT ALT NAME:
= ALT1
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT1
  NAME     : UTIL VALUE
 SENBOKU   :     0.7873
 KI        :     0.7501
 KA        :     0.8302
 IZ        :     0.7817
 KIP       :     0.7998
 KISI      :     0.2500
 KAP       :     0.8534
 KASI      :     0.4518
 IZP       :     0.8053
 IZSI      :     0.3102
 KIPA      :     0.7876
 KIPF      :     0.6011
 KIPS      :     0.7668
 KISIL     :     0.2262
 KISIN     :     0.5101
 KAPA      :     0.7886
 KAPF      :     0.7389
 KAPS      :     0.4063
 KASIL     :     0.4524
 KASIN     :     0.3786
 IZPA      :     0.7745
 IZPF      :     0.7464
 IZSIL     :     0.3045
 IZSIN     :     0.4907
 KIPAF     :     0.7636
 KIPAP     :     0.5924
 KIPAS     :     0.6783
 KIPFF     :     0.5037
 KIPFS     :     0.5697
 KIPSF     :     0.5530
 KIPSPFO   :     0.5753
 KIPSS     :     0.5767
 KISILTE   :     0.1498
 KISILAP   :     0.1241
 KISILWO   :     0.6018
 KISILCL   :     0.6386
 KISINSE   :     0.7322
 KISINME   :     0.4316
 KISINMC   :     0.3994
```

KAPAF	:	0.8807
KAPAP	:	0.6223
KAPAS	:	0.5409
KAPFF	:	0.6221
KAPFS	:	0.6957
KAPSF	:	0.1311
KAPSPFO	:	0.0208
KAPSS	:	0.4677
KASILTE	:	0.2682
KASILAP	:	0.1752
KASILWO	:	0.6074
KASILCL	:	0.4592
KASINSE	:	0.5934
KASINME	:	0.3105
KASINMC	:	0.4372
IZPAF	:	0.7557
IZPAP	:	0.5197
IZPAS	:	0.6564
IZPFF	:	0.5644
IZPFS	:	0.6734
IZSILTE	:	0.2915
IZSILAP	:	0.2661
IZSILWO	:	0.2418
IZSILCL	:	0.1640
IZSINCH	:	0.5939
IZSINSE	:	0.7107
IZSINME	:	0.3990
IZSINMC	:	0.4854
IZSINNM	:	0.7131
KIPAFMC	:	0.5841
KIPAFWT	:	0.9643
KIPAFLB	:	0.6071
KIPAPPD	:	0.5620
KIPAPFD	:	0.3766
KIPAPLP	:	0.8525
KIPASHA	:	0.3451
KIPASCL	:	0.7562
KIPASHN	:	0.5000
KIPFFLB	:	0.3514
KIPFFFA	:	0.6750
KIPFSCO	:	0.4649
KIPFSDN	:	0.5700
KIPFSPT	:	0.2646
KIPSFFS	:	0.5945
KIPSFLB	:	0.5601
KIPSSCL	:	0.5802
KIPSSNL	:	0.4645

KISILTEL	:	0.4200
KISILTEW	:	0.1318
KISILTEF	:	0.2360
KISILAPL	:	0.3400
KISILAPW	:	0.1193
KISILAPF	:	0.2460
KISILWOL	:	0.5674
KISILWOW	:	0.3981
KISILWOF	:	0.6306
KISILCLL	:	0.5776
KISILCLW	:	0.4165
KISILCLF	:	0.7518
KISINSEL	:	0.6908
KISINSEW	:	0.6570
KISINSEF	:	0.6203
KISINMEL	:	0.6700
KISINMEW	:	0.3900
KISINMEF	:	0.5891
KISINMCL	:	0.3800
KISINMCW	:	0.2284
KISINMCF	:	0.4220
KAPAFMC	:	0.7445
KAPAFWT	:	0.8642
KAPAFLB	:	0.6929
KAPAPPD	:	0.6337
KAPAPFD	:	0.4075
KAPAPLP	:	0.7340
KAPASHA	:	0.3312
KAPASCL	:	0.6525
KAPASHN	:	0.4714
KAPFFLB	:	0.2500
KAPFFFA	:	0.6560
KAPFSCO	:	0.6584
KAPFSDN	:	0.5811
KAPFSPT	:	0.3479
KAPSFFS	:	0.
KAPSFLB	:	0.1457
KAPSSCL	:	0.5454
KAPSSNL	:	0.1865
KASILTEL	:	0.4350
KASILTEW	:	0.2433
KASILTEF	:	0.4343
KASILAPL	:	0.1550
KASILAPW	:	0.1092
KASILAPF	:	0.2370
KASILWOL	:	0.6350
KASILWOW	:	0.1820
KASILWOF	:	0.3360
KASILCLL	:	0.4433
KASILCLW	:	0.3589
KASILCLF	:	0.8183
KASINSEL	:	0.6767
KASINSEW	:	0.4948
KASINSEF	:	0.7556
KASINMEL	:	0.6200
KASINMEW	:	0.2404
KASINMEF	:	0.4800
KASINMCL	:	0.4050
KASINMCW	:	0.2391
KASINMCF	:	0.5350

IZPAFMC :	0.5677
IZPAFWT :	0.9342
IZPAFLB :	0.7180
IZPAPPD :	0.5518
IZPAPFD :	0.3676
IZPAPLP :	0.8901
IZPASHA :	0.3451
IZPASCL :	0.7313
IZPASHN :	0.5283
IZPFFLB :	0.4973
IZPFFFA :	0.6430
IZPFSCO :	0.5666
IZPFSDN :	0.5943
IZPFSPT :	0.4618
IZSILTEL :	0.5700
IZSILTEW :	0.1446
IZSILTEF :	0.1750
IZSILAPL :	0.2600
IZSILAPW :	0.1215
IZSILAPF :	0.3520
IZSILWOL :	0.2222
IZSILWOW :	0.0907
IZSILWOF :	0.3013
IZSILCLL :	0.4200
IZSILCLW :	0.1517
IZSILCLF :	0.1830
IZSINCHL :	0.8217
IZSINCHW :	0.5264
IZSINCHF :	0.5585
IZSINSEL :	0.7475
IZSINSEW :	0.6540
IZSINSEF :	0.7875
IZSINMEL :	0.4000
IZSINMEW :	0.1746
IZSINMEF :	0.3280
IZSINMCL :	0.4850
IZSINMCW :	0.1600
IZSINMCF :	0.3590
IZSINNML :	0.6122
IZSINNMW :	0.5827
IZSINNMF :	0.9559
KIPAFWTN :	0.9611
KIPAFWTV :	0.6669
KIPAFWTL :	0.7351
KIPAPLPR :	0.7475
KIPAPLPF :	0.6793
KAPAFWTN :	0.8553
KAPAFWTV :	0.4903
KAPAFWTL :	0.7685
KAPAPLPR :	0.5818
KAPAPLPF :	0.5638
IZPAFWTN :	0.7728
IZPAFWTV :	0.9505
IZPAFWTL :	0.5314
IZPAPLPR :	0.8053
IZPAPLPF :	0.7290

Illustration 12

```
COMMAND:
= GRAD
INPUT ALT NAME:
= ALT1
INPUT UTIL NAME:
= SENBOKU
GRADIENT FOR SENBOKU
  NAME      : UTILITY GRAD  (ATTRIBUTE GRAD)
 KI         :     0.33333
 KA         :     0.33333
 IZ         :     0.33333
 KIP        :     0.29103
 KISI       :     0.04029
 KAP        :     0.26074
 KASI       :     0.04583
 IZP        :     0.31503
 IZSI       :     0.01793
 KIPA       :     0.23396
 KIPF       :     0.01669
 KIPS       :     0.02052
 KISIL      :     0.03524
 KISIN      :     0.00455

 KAPA       :     0.13901
 KAPF       :     0.03358
 KAPS       :     0.02140
 KASIL      :     0.04059
 KASIN      :     0.00540
 IZPA       :     0.06952
 IZPF       :     0.20099
 IZSIL      :     0.01645
 IZSIN      :     0.00132
 KIPAF      :     0.17642
 KIPAP      :     0.01336
 KIPAS      :     0.02154
 KIPFF      :     0.00387
 KIPFS      :     0.01259
 KIPSF      :     0.00317
 KIPSPFO    :     0.01042   (     0.00001    )
 KIPSS      :     0.00358
 KISILTE    :     0.02969
 KISILAP    :     0.00328
 KISILWO    :     0.00281
 KISILCL    :     0.00166
 KISINSE    :     0.00044
 KISINME    :     0.00357

 KISINMC    :     0.00053
```

KAPAF	:	0.02861	
KAPAP	:	0.01598	
KAPAS	:	0.05848	
KAPFF	:	0.00609	
KAPFS	:	0.02458	
KAPSF	:	0.00436	
KAPSPFO	:	0.00540	(0.00005)
KAPSS	:	0.01647	
KASILTE	:	0.00797	
KASILAP	:	0.02463	
KASILWO	:	0.01056	
KASILCL	:	0.00455	
KASINSE	:	0.00046	
KASINME	:	0.00448	
KASINMC	:	0.00057	
IZPAF	:	0.04824	
IZPAP	:	0.00545	
IZPAS	:	0.00905	
IZPFF	:	0.03797	
IZPFS	:	0.14275	
IZSILTE	:	0.00268	
IZSILAP	:	0.00124	
IZSILWO	:	0.01350	
IZSILCL	:	0.00169	
IZSINCH	:	0.00008	
IZSINSE	:	0.00004	
IZSINME	:	0.00103	
IZSINMC	:	0.00016	
IZSINNM	:	0.00002	
KIPAFMC	:	0.01240	(0.00404)
KIPAFWT	:	0.02341	
KIPAFLB	:	0.10250	(0.00993)
KIPAPPD	:	0.00220	(0.00025)
KIPAPFD	:	0.00816	(0.00182)
KIPAPLP	:	0.00215	
KIPASHA	:	0.01013	(0.00449)
KIPASCL	:	0.00641	(0.00016)
KIPASHN	:	0.00326	(0.00154)
KIPFFLB	:	0.00257	(0.00344)
KIPFFFA	:	0.00128	(0.00013)
KIPFSCO	:	0.00893	(0.01058)
KIPFSDN	:	0.00257	(0.00001)
KIPFSPT	:	0.00139	(0.06321)
KIPSFFS	:	0.00011	(0.00001)
KIPSFLB	:	0.00308	(0.00035)
KIPSSCL	:	0.00271	(0.00115)
KIPSSNL	:	0.00087	(0.00042)

KISILTEL :	0.00073	(0.00004)	
KISILTEW :	0.02661	(0.00308)	
KISILTEF :	0.00261	(0.00003)	
KISILAPL :	0.00009	(0.00000)	
KISILAPW :	0.00286	(0.00032)	
KISILAPF :	0.00018	(0.00000)	
KISILWOL :	0.00190	(0.00006)	
KISILWOW :	0.00066	(0.00012)	
KISILWOF :	0.00021	(0.00000)	
KISILCLL :	0.00109	(0.00004)	
KISILCLW :	0.00029	(0.00005)	
KISILCLF :	0.00021	(0.00000)	
KISINSEL :	0.00006	(0.00000)	
KISINSEW :	0.00028	(0.00004)	
KISINSEF :	0.00005	(0.00000)	
KISINMEL :	0.00019	(0.00001)	
KISINMEW :	0.00300	(0.00050)	
KISINMEF :	0.00039	(0.00000)	
KISINMCL :	0.00049	(0.00002)	
KISINMCW :	0.00002	(0.00000)	
KISINMCF :	0.00004	(0.00000)	
KAPAFMC :	0.00207	(0.00060)	
KAPAFWT :	0.01681		
KAPAFLB :	0.00327	(0.00031)	
KAPAPPD :	0.00308	(0.00032)	
KAPAPFD :	0.00903	(0.00194)	
KAPAPLP :	0.00273		
KAPASHA :	0.03855	(0.01767)	
KAPASCL :	0.01361	(0.00037)	
KAPASHN :	0.00712	(0.00340)	
KAPFFLB :	0.00077	(0.00139)	
KAPFFFA :	0.00535	(0.00054)	
KAPFSCO :	0.01999	(0.01926)	
KAPFSDN :	0.00154	(0.00001)	
KAPFSPT :	0.00220	(0.08076)	
KAPSFES :	0.00102	(0.00032)	
KAPSFLB :	0.00393	(0.00074)	
KAPSSCL :	0.01191	(0.00525)	
KAPSSNL :	0.00518	(0.00340)	
KASILTEL :	0.00035	(0.00002)	
KASILTEW :	0.00694	(0.00116)	
KASILTEF :	0.00069	(0.00000)	
KASILAPL :	0.02159	(0.00108)	
KASILAPW :	0.00367	(0.00041)	
KASILAPF :	0.00199	(0.00002)	
KASILWOL :	0.00831	(0.00042)	
KASILWOW :	0.00080	(0.00010)	
KASILWOF :	0.00167	(0.00002)	
KASILCLL :	0.00063	(0.00002)	
KASILCLW :	0.00356	(0.00067)	
KASILCLF :	0.00039	(0.00000)	
KASINSEL :	0.00003	(0.00000)	
KASINSEW :	0.00035	(0.00006)	
KASINSEF :	0.00006	(0.00000)	
KASINMEL :	0.00034	(0.00002)	
KASINMEW :	0.00381	(0.00052)	
KASINMEF :	0.00042	(0.00000)	
KASINMCL :	0.00049	(0.00002)	
KASINMCW :	0.00004	(0.00001)	
KASINMCF :	0.00006	(0.00000)	

IZPAFMC	:	0.02428	(0.00800)
IZPAFWT	:	0.00954	
IZPAFLB	:	0.00576	(0.00053)
IZPAPPD	:	0.00088	(0.00010)
IZPAPFD	:	0.00401	(0.00090)
IZPAPLP	:	0.00043	
IZPASHA	:	0.00435	(0.00193)
IZPASCL	:	0.00267	(0.00007)
IZPASHN	:	0.00145	(0.00068)
IZPFFLB	:	0.02501	(0.02254)
IZPFFFA	:	0.01277	(0.00128)
IZPFSCO	:	0.03169	(0.03382)
IZPFSDN	:	0.01931	(0.00008)
IZPFSPT	:	0.08161	(2.44609)
IZSILTEL	:	0.00037	(0.00002)
IZSILTEW	:	0.00109	(0.00013)
IZSILTEF	:	0.00195	(0.00002)
IZSILAPL	:	0.00103	(0.00005)
IZSILAPW	:	0.00019	(0.00002)
IZSILAPF	:	0.00009	(0.00000)
IZSILWOL	:	0.01184	(0.00051)
IZSILWOW	:	0.00078	(0.00006)
IZSILWOF	:	0.00163	(0.00007)
IZSILCLL	:	0.00004	(0.00000)
IZSILCLW	:	0.00159	(0.00019)
IZSILCLF	:	0.00009	(0.00000)
IZSINCHL	:	0.00001	(0.00000)
IZSINCHW	:	0.00006	(0.00001)
IZSINCHF	:	0.00001	(0.00000)
IZSINSEL	:	0.00000	(0.00000)
IZSINSEW	:	0.00003	(0.00000)
IZSINSEF	:	0.00000	(0.00000)
IZSINMEL	:	0.00085	(0.00004)
IZSINMEW	:	0.00007	(0.00001)
IZSINMEF	:	0.00015	(0.00000)
IZSINMCL	:	0.00013	(0.00001)
IZSINMCW	:	0.00002	(0.00000)
IZSINMCF	:	0.00002	(0.00000)
IZSINNML	:	0.00001	(0.00000)
IZSINNMW	:	0.00000	(0.00000)
IZSINNMF	:	0.00000	(0.00000)
KIPAFWTN	:	0.00791	(0.00004)
KIPAFWTV	:	0.00168	(0.00000)
KIPAFWTL	:	0.00091	(0.00000)
KIPAPLPR	:	0.00098	(0.00003)
KIPAPLPF	:	0.00057	(0.00002)
KAPAFWTN	:	0.00221	(0.00003)
KAPAFWTV	:	0.00131	(0.00000)
KAPAFWTL	:	0.00808	(0.00000)
KAPAPLPR	:	0.00145	(0.00009)
KAPAPLPF	:	0.00102	(0.00007)
IZPAFWTN	:	0.00117	(0.00002)
IZPAFWTV	:	0.00304	(0.00000)
IZPAFWTL	:	0.00078	(0.00000)
IZPAPLPR	:	0.00018	(0.00000)
IZPAPLPF	:	0.00010	(0.00000)

Illustration 13

```
COMMAND:
= READ
DATA IS READ.

COMMAND:
= ADDALT
INPUT ALT NAME:
= ALT2
WANT LIST OF ALT TYPE?
= YES
LIST OF ALT TYPE
  (1) CERTAINTY
  (2) PROBABILITY : DISCRETE DISTRIBUTION
  (3) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE LINEAR)
  (4) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE QUADRATIC)
KIPAFMC ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.50
KIPAFWTN---INPUT ALT TYPE:
= 1

INPUT VALUE OF THE ATTRIBUTE:
= 39.47
KIPAFWTV---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 145.19
KIPAFWTL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3229.6
KIPAFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 5.58
KIPAPPD ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3.53
KIPAPFD ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.41
KIPAPLPR---INPUT ALT TYPE:

= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.93
KIPAPLPF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 5.43
```

```
KIPASHA ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.40
KIPASCL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 19.0
KIPASHN ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.85
KIPFFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.164

KIPFFFA ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.75
KIPFSCO ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.27
KIPFSDN ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 95.24
KIPFSPT ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.0033
KIPSFFS ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.98
KIPSFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:

= 3.5
KIPSPFO ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 289.5
KIPSSCL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.93
KIPSSNL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.75
```

```
KISILTEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 8.4
KISILTEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.55
KISILTEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 23.6
KISILAPL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.8
KISILAPW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.18
KISILAPF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 24.6
KISILWOL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 12.9
KISILWOW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.93
KISILWOF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 136.6
KISILCLL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 13.2
KISILCLW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.03
KISILCLF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 177.5
```

```
KISINSEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 16.7
KISINSEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.73

KISINSEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 225.2
KISINMEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 13.4
KISINMEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.34
KISINMEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 92.1
KISINMCL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 7.6
KISINMCW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:

= 2.07
KISINMCF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 42.2
```

Illustration 14

```
COMMAND:
= READ
DATA IS READ.

COMMAND:
= ADDALT
INPUT ALT NAME:
= ALT3
WANT LIST OF ALT TYPE?
= YES
LIST OF ALT TYPE
 (1) CERTAINTY
 (2) PROBABILITY : DISCRETE DISTRIBUTION
 (3) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE LINEAR)
 (4) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE QUADRATIC)
KIPAFMC ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.65
KIPAFWIN---INPUT ALT TYPE:
= 1

INPUT VALUE OF THE ATTRIBUTE:
= 39.47
KIPAFWTV---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 145.19
KIPAFWTL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3229.6
KIPAFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.14
KIPAPPD ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 3.53
KIPAPFD ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.41
KIPAPLPR---INPUT ALT TYPE:

= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.93
KIPAPLPF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 5.43
```

```
KIPASHA ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.42
KIPASCL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 19.0
KIPASHN ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.85
KIPFFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.164

KIPFFFA ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.75
KIPFSCO ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.27
KIPFSDN ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 95.24
KIPFSPT ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.0033
KIPSFFS ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.98
KIPSFLB ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:

= 3.5
KIPSPFO ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 318.45
KIPSSCL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.93
KIPSSNL ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.75
```

```
KISILTEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 8.4
KISILTEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.29
KISILTEF---INPUT ALT TYPE:
= 1

INPUT VALUE OF THE ATTRIBUTE:
= 23.6
KISILAPL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 6.8
KISILAPW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.18
KISILAPF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 24.6
KISILWOL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 12.9
KISILWOW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1.93
KISILWOF---INPUT ALT TYPE:

= 1
INPUT VALUE OF THE ATTRIBUTE:
= 136.6
KISILCLL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 13.2
KISILCLW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.03
KISILCLF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 177.5
```

```
KISINSEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 16.7
KISINSEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.73

KISINSEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 225.2
KISINMEL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 13.4
KISINMEW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 2.34
KISINMEF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 92.1
KISINMCL---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 7.6
KISINMCW---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:

= 2.07
KISINMCF---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 42.2
```

Illustration 15

```
COMMAND:
= READ
DATA IS READ.

COMMAND:
= EVAL
INPUT ALT NAME:
= ALT2
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT2
  NAME     : UTIL VALUE
 SENBOKU   :    0.7900
 KI        :    0.7525
 KA        :    0.8331
 IZ        :    0.7844
 KIP       :    0.7998
 KISI      :    0.2702
 KAP       :    0.8534
 KASI      :    0.4730
 IZP       :    0.8053

 IZSI      :    0.3595
 KIPA      :    0.7876
 KIPF      :    0.6011
 KIPS      :    0.7668
 KISIL     :    0.2494
 KISIN     :    0.5101
 KAPA      :    0.7886
 KAPF      :    0.7389
 KAPS      :    0.4063
 KASIL     :    0.4764
 KASIN     :    0.3786
 IZPA      :    0.7745
 IZPF      :    0.7464
 IZSIL     :    0.3582
 IZSIN     :    0.4907
 KIPAF     :    0.7636
 KIPAP     :    0.5924
 KIPAS     :    0.6783
 KIPFF     :    0.5037
 KIPFS     :    0.5697
 KIPSF     :    0.5530
 KIPSPFO   :    0.5753
 KIPSS     :    0.5767

 KISILTE   :    0.1772
 KISILAP   :    0.1241
 KISILWO   :    0.6018
 KISILCL   :    0.6386
 KISINSE   :    0.7322
 KISINME   :    0.4316
 KISINMC   :    0.3994
```

KAPAF	:	0.8807
KAPAP	:	0.6223
KAPAS	:	0.5409
KAPFF	:	0.6221
KAPFS	:	0.6957
KAPSF	:	0.1311
KAPSPFO	:	0.0208
KAPSS	:	0.4677
KASILTE	:	0.2682
KASILAP	:	0.2146
KASILWO	:	0.6074
KASILCL	:	0.4592
KASINSE	:	0.5934
KASINME	:	0.3105
KASINMC	:	0.4372
IZPAF	:	0.7557
IZPAP	:	0.5197
IZPAS	:	0.6564
IZPFF	:	0.5644
IZPFS	:	0.6734
IZSILTE	:	0.2915
IZSILAP	:	0.2661
IZSILWO	:	0.3072
IZSILCL	:	0.1640
IZSINCH	:	0.5939
IZSINSE	:	0.7107
IZSINME	:	0.3990
IZSINMC	:	0.4854
IZSINNM	:	0.7131
KIPAFMC	:	0.5841
KIPAFWT	:	0.9643
KIPAFLB	:	0.6071
KIPAPPD	:	0.5620
KIPAPFD	:	0.3766
KIPAPLP	:	0.8525
KIPASHA	:	0.3451
KIPASCL	:	0.7562
KIPASHN	:	0.5000
KIPFFLB	:	0.3514
KIPFFFA	:	0.6750
KIPFSCO	:	0.4649
KIPFSDN	:	0.5700
KIPFSPT	:	0.2646
KIPSFFS	:	0.5945
KIPSFLB	:	0.5601
KIPSSCL	:	0.5802
KIPSSNL	:	0.4645

KISILTEL	:	0.4200
KISILTEW	:	0.1624
KISILTEF	:	0.2360
KISILAPL	:	0.3400
KISILAPW	:	0.1193
KISILAPF	:	0.2460
KISILWOL	:	0.5674
KISILWOW	:	0.3981
KISILWOF	:	0.6306
KISILCLL	:	0.5776
KISILCLW	:	0.4165
KISILCLF	:	0.7518
KISINSEL	:	0.6908
KISINSEW	:	0.6570
KISINSEF	:	0.6203
KISINMEL	:	0.6700
KISINMEW	:	0.3900
KISINMEF'	:	0.5891
KISINMCL	:	0.3800
KISINMCW	:	0.2284
KISINMCF	:	0.4220
KAPAFMC	:	0.7445
KAPAFWT	:	0.8642
KAPAFLB	:	0.6929
KAPAPPD	:	0.6337
KAPAPFD	:	0.4075
KAPAPLP	:	0.7340
KAPASHA	:	0.3312
KAPASCL	:	0.6525
KAPASHN	:	0.4714
KAPFFLB	:	0.2500
KAPFFFA	:	0.6560
KAPFSCO	:	0.6584
KAPFSDN	:	0.5811
KAPFSPT	:	0.3479
KAPSFFS	:	0.
KAPSFLB	:	0.1457
KAPSSCL	:	0.5454
KAPSSNL	:	0.1865
KASILTEL	:	0.4350
KASILTEW	:	0.2433
KASILTEF	:	0.4343
KASILAPL	:	0.2000
KASILAPW	:	0.1092
KASILAPF	:	0.2370
KASILWOL	:	0.6350
KASILWOW	:	0.1820
KASILWOF	:	0.3360
KASILCLL	:	0.4433
KASILCLW	:	0.3589
KASILCLF	:	0.8183
KASINSEL	:	0.6767
KASINSEW	:	0.4948
KASINSEF	:	0.7556
KASINMEL	:	0.6200
KASINMEW	:	0.2404
KASINMEF	:	0.4800
KASINMCL	:	0.4050
KASINMCW	:	0.2391
KASINMCF	:	0.5350

IZPAFMC	:	0.5677
IZPAFWT	:	0.9342
IZPAFLB	:	0.7180
IZPAPPD	:	0.5518
IZPAPFD	:	0.3676
IZPAPLP	:	0.8901
IZPASHA	:	0.3451
IZPASCL	:	0.7313
IZPASHN	:	0.5283
IZPFFLB	:	0.4973
IZPFFFA	:	0.6430
IZPFSCO	:	0.5666
IZPFSDN	:	0.5943
IZPFSPT	:	0.4618
IZSILTEL	:	0.5700
IZSILTEW	:	0.1446
IZSILTEF	:	0.1750
IZSILAPL	:	0.2600
IZSILAPW	:	0.1215
IZSILAPF	:	0.3520
IZSILWOL	:	0.2968
IZSILWOW	:	0.0907
IZSILWOF	:	0.3013
IZSILCLL	:	0.4200
IZSILCLW	:	0.1517
IZSILCLF	:	0.1830
IZSINCHL	:	0.8217
IZSINCHW	:	0.5264
IZSINCHF	:	0.5585
IZSINSEL	:	0.7475
IZSINSEW	:	0.6540
IZSINSEF	:	0.7875
IZSINMEL	:	0.4000
IZSINMEW	:	0.1746
IZSINMEF	:	0.3280
IZSINMCL	:	0.4850
IZSINMCW	:	0.1600
IZSINMCF	:	0.3590
IZSINNML	:	0.6122
IZSINNMW	:	0.5827
IZSINNMF	:	0.9559
KIPAFWTN	:	0.9611
KIPAFWTV	:	0.6669
KIPAFWTL	:	0.7351
KIPAPLPR	:	0.7475
KIPAPLPF	:	0.6793
KAPAFWTN	:	0.8553
KAPAFWTV	:	0.4903
KAPAFWTL	:	0.7685
KAPAPLPR	:	0.5818
KAPAPLPF	:	0.5638
IZPAFWTN	:	0.7728
IZPAFWTV	:	0.9505
IZPAFWTL	:	0.5314
IZPAPLPR	:	0.8053
IZPAPLPF	:	0.7290

Illustration 16

```
COMMAND:
= EVAL
INPUT ALT NAME:
= ALT3
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT3
  NAME     : UTIL VALUE
 SENBOKU   :    0.7983
 KI        :    0.7691
 KA        :    0.8332
 IZ        :    0.7926
 KIP       :    0.8217

 KISI      :    0.2500
 KAP       :    0.8572
 KASI      :    0.4518
 IZP       :    0.8168
 IZSI      :    0.3102
 KIPA      :    0.8138
 KIPF      :    0.6011
 KIPS      :    0.7784
 KISIL     :    0.2262
 KISIN     :    0.5101
 KAPA      :    0.7933
 KAPF      :    0.7447
 KAPS      :    0.4137
 KASIL     :    0.4524
 KASIN     :    0.3786
 IZPA      :    0.7915
 IZPF      :    0.7585
 IZSIL     :    0.3045
 IZSIN     :    0.4907
 KIPAF     :    0.7979
 KIPAP     :    0.5924
 KIPAS     :    0.6826
 KIPFF     :    0.5037

 KIPFS     :    0.5697
 KIPSF     :    0.5530
 KIPSPFO   :    0.5982
 KIPSS     :    0.5767
 KISILTE   :    0.1498
 KISILAP   :    0.1241
 KISILWO   :    0.6018
 KISILCL   :    0.6386
 KISINSE   :    0.7322
 KISINME   :    0.4316
 KISINMC   :    0.3994
```

KAPAF	:	0.8807
KAPAP	:	0.6223
KAPAS	:	0.5520
KAPFF	:	0.6221
KAPFS	:	0.7035
KAPSF	:	0.1311
KAPSPFO	:	0.0208
KAPSS	:	0.4773
KASILTE	:	0.2682
KASILAP	:	0.1752
KASILWO	:	0.6074
KASILCL	:	0.4592
KASINSE	:	0.5934
KASINME	:	0.3105
KASINMC	:	0.4372
IZPAF	:	0.7803
IZPAP	:	0.5197
IZPAS	:	0.6564
IZPFF	:	0.5882
IZPFS	:	0.6844
IZSILTE	:	0.2915
IZSILAP	:	0.2661
IZSILWO	:	0.2418
IZSILCL	:	0.1640
IZSINCH	:	0.5939
IZSINSE	:	0.7107
IZSINME	:	0.3990
IZSINMC	:	0.4854
IZSINNM	:	0.7131
KIPAFMC	:	0.6323
KIPAFWT	:	0.9643
KIPAFLB	:	0.6608
KIPAPPD	:	0.5620
KIPAPFD	:	0.3766
KIPAPLP	:	0.8525
KIPASHA	:	0.3541
KIPASCL	:	0.7562
KIPASHN	:	0.5000
KIPFFLB	:	0.3514
KIPFFFA	:	0.6750
KIPFSCO	:	0.4649
KIPFSDN	:	0.5700
KIPFSPT	:	0.2646
KIPSFFS	:	0.5945
KIPSFLB	:	0.5601
KIPSSCL	:	0.5802
KIPSSNL	:	0.4645

KISILTEL	:	0.4200
KISILTEW	:	0.1318
KISILTEF	:	0.2360
KISILAPL	:	0.3400
KISILAPW	:	0.1193
KISILAPF	:	0.2460
KISILWOL	:	0.5674
KISILWOW	:	0.3981
KISILWOF	:	0.6306
KISILCLL	:	0.5776
KISILCLW	:	0.4165
KISILCLF	:	0.7518
KISINSEL	:	0.6908
KISINSEW	:	0.6570
KISINSEF	:	0.6203
KISINMEL	:	0.6700
KISINMEW	:	0.3900
KISINMEF	:	0.5891
KISINMCL	:	0.3800
KISINMCW	:	0.2284
KISINMCF	:	0.4220
KAPAFMC	:	0.7445
KAPAFWT	:	0.8642
KAPAFLB	:	0.6929
KAPAPPD	:	0.6337
KAPAPFD	:	0.4075
KAPAPLP	:	0.7340
KAPASHA	:	0.3406
KAPASCL	:	0.6742
KAPASHN	:	0.4714
KAPFFLB	:	0.2500
KAPFFFA	:	0.6560
KAPFSCO	:	0.6680
KAPFSDN	:	0.5811
KAPFSPT	:	0.3479
KAPSFFS	:	0.
KAPSFLB	:	0.1457
KAPSSCL	:	0.5586
KAPSSNL	:	0.1865
KASILTEL	:	0.4350
KASILTEW	:	0.2433
KASILTEF	:	0.4343
KASILAPL	:	0.1550
KASILAPW	:	0.1092
KASILAPF	:	0.2370
KASILWOL	:	0.6350
KASILWOW	:	0.1820
KASILWOF	:	0.3360
KASILCLL	:	0.4433
KASILCLW	:	0.3589
KASILCLF	:	0.8183
KASINSEL	:	0.6767
KASINSEW	:	0.4948
KASINSEF	:	0.7556
KASINMEL	:	0.6200
KASINMEW	:	0.2404
KASINMEF	:	0.4800
KASINMCL	:	0.4050
KASINMCW	:	0.2391
KASINMCF	:	0.5350

IZPAFMC	:	0.6164
IZPAFWT	:	0.9342
IZPAFLB	:	0.7180
IZPAPPD	:	0.5518
IZPAPFD	:	0.3676
IZPAPLP	:	0.8901
IZPASHA	:	0.3451
IZPASCL	:	0.7313
IZPASHN	:	0.5283
IZPFFLB	:	0.5238
IZPFFFA	:	0.6620
IZPFSCO	:	0.5773
IZPFSDN	:	0.6074
IZPFSPT	:	0.4738
IZSILTEL	:	0.5700
IZSILTEW	:	0.1446
IZSILTEF	:	0.1750
IZSILAPL	:	0.2600
IZSILAPW	:	0.1215
IZSILAPF	:	0.3520
IZSILWOL	:	0.2222
IZSILWOW	:	0.0907
IZSILWOF	:	0.3013
IZSILCLL	:	0.4200
IZSILCLW	:	0.1517
IZSILCLF	:	0.1830
IZSINCHL	:	0.8217
IZSINCHW	:	0.5264
IZSINCHF	:	0.5585
IZSINSEL	:	0.7475
IZSINSEW	:	0.6540
IZSINSEF	:	0.7875
IZSINMEL	:	0.4000
IZSINMEW	:	0.1746
IZSINMEF	:	0.3280
IZSINMCL	:	0.4850
IZSINMCW	:	0.1600
IZSINMCF	:	0.3590
IZSINNML	:	0.6122
IZSINNMW	:	0.5827
IZSINNMF	:	0.9559
KIPAFWTN	:	0.9611
KIPAFWTV	:	0.6669
KIPAFWTL	:	0.7351
KIPAPLPR	:	0.7475
KIPAPLPF	:	0.6793
KAPAFWTN	:	0.8553
KAPAFWTV	:	0.4903
KAPAFWTL	:	0.7685
KAPAPLPR	:	0.5818
KAPAPLPF	:	0.5638
IZPAFWTN	:	0.7728
IZPAFWTV	:	0.9505
IZPAFWTL	:	0.5314
IZPAPLPR	:	0.8053
IZPAPLPF	:	0.7290

Illustration 17

```
COMMAND:
= INPUT
INPUT MNAME:
= AG
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 3
INPUT UNAME:
= KI
= KA
= IZ
ANOTHER INPUT?
= NO

COMMAND:
= UNISET
INPUT UNIF NAME:
= KI
WANT LIST OF UNIF TYPE?

= YES
LIST OF UNIF TYPE
 (1) LINEAR
 (2) PIECEWISE LINEAR
 (3) CONSTANT RISK
 (4) DECREASING RISK AVERSE
 (5) INCREASING RISK PRONE
INPUT UNIF TYPE:
= 1
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= YES
INPUT UNIF NAME:
= KA
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= YES

INPUT UNIF NAME:
= IZ
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= NO
```

```
COMMAND:
= KSET
INPUT MNAME:
= AG
WANT LIST OF THE METHOD FOR KSET?
= YES
LIST OF THE METHOD FOR KSET
 (1) BY INPUT OF K'S VALUES DIRECTRY
 (2) BY INDIFFERENCE PAIRS AND LOTTERY
 (3) BY INDIFFRENCE PAIRS
WHICH METHOD DO YOU USE?
= 1

INPUT THE VALUE OF K.
K(KI       ) :
= 0.3
K(KA       ) :
= 0.5
K(IZ       ) :
= 0.2
* CAPITAL K =    0.
ANOTHER KSET?
= NO

COMMAND:
= DISPLAY
INPUT UTIL NAME:
= AG
(MUF)
AG      ----KI         ( K =   0.3000 )
           !
           !--KA         ( K =   0.5000 )
           !
           !--IZ         ( K =   0.2000 )
* CAPITAL K =    0.


COMMAND:
= ADDALT
INPUT ALT NAME:
= ALT-1
WANT LIST OF ALT TYPE?
= YES
LIST OF ALT TYPE
 (1) CERTAINTY
 (2) PROBABILITY : DISCRETE DISTRIBUTION
 (3) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE LINEAR)
 (4) PROBABILITY : CONTINUOUS DISTRIBUTION (PIECEWISE QUADRATIC)
KI      ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.7876
KA      ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.7886
IZ      ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.7745
```

```
COMMAND:
= EVAL
INPUT ALT NAME:
= ALT-1
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT-1
  NAME     : UTIL VALUE
 AG        :     0.7855
 KI        :     0.7876
 KA        :     0.7886
 IZ        :     0.7745
```

Illustration 18

```
COMMAND:
= INPUT
INPUT MNAME:
= FO
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 3
INPUT UNAME:
= KI
= KA
= IZ
ANOTHER INPUT?
= NO

COMMAND:
= UNISET
INPUT UNIF NAME:
= KI
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1

INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= YES
INPUT UNIF NAME:
= KA
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= NO

COMMAND:
= UNISET
INPUT UNIF NAME:
= IZ
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1

INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= NO
```

```
COMMAND:
= KSET
INPUT MNAME:
= FO
WANT LIST OF THE METHOD FOR KSET?
= NO
WHICH METHOD DO YOU USE?
= 1
INPUT THE VALUE OF K.
K(KI       ) :
= 0.2
K(KA       ) :
= 0.3
K(IZ       ) :
= 0.5
* CAPITAL K =     0.
ANOTHER KSET?
= NO


COMMAND:
= ADDALT
INPUT ALT NAME:
= ALT-2
WANT LIST OF ALT TYPE?
= NO
KI       ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.6011
KA       ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.7389
IZ       ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.7464

COMMAND:
= EVAL
INPUT ALT NAME:

= ALT-2
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT-2
  NAME     : UTIL VALUE
 FO        :     0.7151
 KI        :     0.6011
 KA        :     0.7389
 IZ        :     0.7464
```

Illustration 19

```
* RUN ICOPSS-1

COMMAND:
= INPUT
INPUT MNAME:
= FI
HOW MANY ATTRIBUTE ARE IN THIS MUF?
= 2
INPUT UNAME:
= KI
= KA
ANOTHER INPUT?
= NO

COMMAND:
= UNISET
INPUT UNIF NAME:
= KI
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1
INPUT RANGE(WORST & BEST) OF THIS UNIF:

= 0.0 1.0
ANOTHER UNISET?
= YES
INPUT UNIF NAME:
= KA
WANT LIST OF UNIF TYPE?
= NO
INPUT UNIF TYPE:
= 1
INPUT RANGE(WORST & BEST) OF THIS UNIF:
= 0.0 1.0
ANOTHER UNISET?
= NO

COMMAND:
= KSET
INPUT MNAME:
= FI
WANT LIST OF THE METHOD FOR KSET?
= NO
WHICH METHOD DO YOU USE?
= 1
INPUT THE VALUE OF K.

K(KI        ) :
= 0.6
K(KA        ) :
= 0.4
* CAPITAL K =     0.
ANOTHER KSET?
= NO
```

```
INPUT VALUE OF THE ATTRIBUTE:
= 1
KA       ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 1

COMMAND:
= ADDALT
INPUT ALT NAME:
= ALT-3
WANT LIST OF ALT TYPE?
= NO
KI       ---INPUT ALT TYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.7668
KA       ---INPUT ALT TYPE:
= 0.4063
ALT TYPE IS NOT VALID. RETYPE:
= 1
INPUT VALUE OF THE ATTRIBUTE:
= 0.4063


COMMAND:
= EVAL
INPUT ALT NAME:
= ALT-3
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT-3
  NAME     : UTIL VALUE
 FI        :     0.6226
 KI        :     0.7668
 KA        :     0.4063

COMMAND:
= KSET
INPUT MNAME:
= FI
WANT LIST OF THE METHOD FOR KSET?
= NO
WHICH METHOD DO YOU USE?
= 1
INPUT THE VALUE OF K.
K(KI       ) :

= 0.7
K(KA       ) :
= 0.3
* CAPITAL K =      0.
ANOTHER KSET?
= NO

COMMAND:
= EVAL
INPUT ALT NAME:
= ALT-3
INPUT UTIL NAME (OR ALL):
= ALL
EVALUTION OF ALT-3
  NAME     : UTIL VALUE
 FI        :     0.6586
 KI        :     0.7668
 KA        :     0.4063
```

APPENDIX I. Classification of the way to assess the utility functions.

Industry	Kishiwada			Kaizuka			Izumi		
	Average size of firm		Category for Utility Assessment	Average size of firm		Category for Utility Assessment	Average size of firm		Category for Utility Assessment
	1973	1975		1973	1975		1973	1975	
Textile	80.0	69.2	VI	181.4	202.6	III	50.8	54.0	VI
Apparel	72.1	57.3	VI	28.9	43.8	VI	73.4	70.5	VI
Lumber	428.1	362.6	II	94.8	74.5	VI	14.6	15.3	V
Clay and Stone	277.8	372.7	II	391.8	462.9	II	26.0	39.6	VI
Chemicals	-	-	-	-	-	-	478.3	776.4	I
Iron and Steel	910.3	824.9	I	365.5	466.3	II	778.5	871.4	I
Fabricated Metal products	200.1	195.6	III	71.1	118.8	VI	76.9	76.9	VI
Machinery	94.7	79.1	VI	83.7	100.6	VI	74.9	129.5	VI
Non-ferrous metal	-	-	-	-	-	-	565.0	991.3	I

Note. Average size of firm: manufacturing shipment per the establishment of a firm.

APPENDIX II. Detail of categories for utility assessment (secondary industries)

Category		Labour Productivity:L	Wage Revenue:W	Entrepreneur Gross Revenue:F
I	Best value of attribute	30.	6.	700.
	Type of UNIF	DR	DR	DR
II	Best value of attribute	30.	6.	300.
	Type of UNIF	CR	CR	CR
III	Best value of attribute	20.	6.	200.
	Type of UNIF	LI	LI	CR
IV	Best value of attribute	20.	6.	100.
	Type of UNIF	LI	CP	LI
V	Best value of attribute	20.	6.	20.
	Type of UNIF	CP	IP	CP

Note:
DR - decreasing risk aversion (Type 4)
CR - constant risk aversion (Type 3)
LI - linear (Type 1)
CP - constant risk prone (Type 3)
IP - increasing risk prone (Type 5)

See Table 2.

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