Questions 2:
Choice and Optimisation

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Question 1

Consider a set of all integers z such that $z^2 < 10$. Is it an ordered set? Does this set have the top (maximum) or the bottom (minimum) elements? What are their values if they exist? What happens if the condition is changed to $n^3 < 10$?

Answer: *This set is* $X = \{-3, -2, -1, 0, 1, 2, 3\}$ *and it is ordered. The maximum element is* 3 *and the minimum is* -3. *If* $X = \{z \in \mathbb{Z} : n^3 < 10\}$, *then the set will include all integers* $z \leq 2$. *Hence, the set is infinite and is not bounded below. The maximum element is* 2.

Question 2

What is a choice set? Give examples.

Answer: *This is a set of several elements with a preference relation. A decision must be made to choose one element from the set. For example, when planning a trip, a choice set is the set of all possible routes from the point of departure to the destination. The preference can be based on some attributes of the elements of the set. For example, the attribute may be the length of a route, and the shortest route can be preferable.*

Question 3

What is a utility function? Give an example of a utility function for set $\{\text{False}, \text{Truth}\}$ if truth is preferred to false.

Answer: *Utility is a numerical representation of the preference relation on the choice set, such that higher preference corresponds to higher utility.*

The example can be $u(\textit{False}) = 0$ *and* $u(\textit{Truth}) = 1$, *where 'False'* $\lesssim$ *'Truth' corresponds to* $0 \leq 1$.

Question 4

Consider a choice problem between several designs of an aircraft. Suppose that the choice must be made based on two attributes: The cost and speed of a plane. How can two objectives, to minimise the cost and to maximise the speed, be combined in a single utility function?

Answer: *We can combine the objectives into a single additive utility:*

$$u(x) = u_1(x) + u_2(x)$$

where the first objective $u_1(x) = -Cost(x)$ *is to minimise cost (or equivalently to maximise negative cost), and the second objective is to maximise speed:* $u_2(x) = Speed(x)$*. Combined with the weights, this can be written as:*

$$u(x) = -w_1 Cost(x) + w_2 Speed(x)$$

Question 5

What are the main characteristics of structured and unstructured decisions?

Answer: *Characteristics of structured decisions:*

- *Goals are defined*
- *Information is obtainable and manageable*
- *Appear in a well–defined context and procedures are known*

Characteristics of unstructured decisions:

- *The outcomes are uncertain*
- *Appear in unique context*
- *The required information and resources are hard to assess*

Question 6

Why are structured decisions also called programmable decisions?

Answer: *In structured decisions, all of the factors affecting the decision and its outcome are known and it is also known how to produce a given outcome given the relevant information. In this way, such decisions could be converted to a simple programme of actions that a computer could execute. Hence structured decisions are called programmable.*

Question 7

Which of the following is an unstructured, strategic task?

a) Producing a report on the change of stock at the end of a week;

b) Evaluating the social impact of a new product line;

c) Scheduling the project work for the next six months;

d) Producing a five year budget plan.

Answer: *Of all of these (2) is most like an unstructured strategic task because evaluating social impact is a very unstructured problem but it is a strategic task as it relates to a new product line and hence could have impact on the whole company. (1) is an operational and structured decision. (3) is more of tactical task and semi-structured as there are many things known about the problem. (4) is strategic because of the time-scale and reasonably structured because there can be good estimates of income and expenses and how to balance the two.*

Question 8

Give examples of structured and unstructured decisions in business. Justify your examples by referring to properties of these types of decisions.

Answer: *A good example of structured decision could be calculation of tax. Indeed, the goal is clearly defined — the amount of money to be taxed. If the profit and the circumstances of how it was obtained are known, then information is obtainable and manageable. There are laws that specify precisely how to pay tax. Thus, the procedures are known. The context is well–defined as the problem is not unique (most people and organisations pay taxes).*

For an example of unstructured decision we may consider a fashion clothes company that is looking to design a new product line. Although the goal is set, it is uncertain what will be in fashion by the time the product line is ready. The outcome is uncertain. Although it is possible to see some repetitions in fashion over time, the new product is supposed to be original. Thus, the problem appears in unique context. It is hard to assess what is required to design a product that will be successful.

Question 9

Briefly describe Simon's model of decision making. Draw the diagram and state what are the outcomes of each phase.

Answer: *According to Simon there are three phases of decision making: Intelligence, Design and Choice. The process can be shown by the following diagram: The outcome of the intelligence phase is problem statement,*

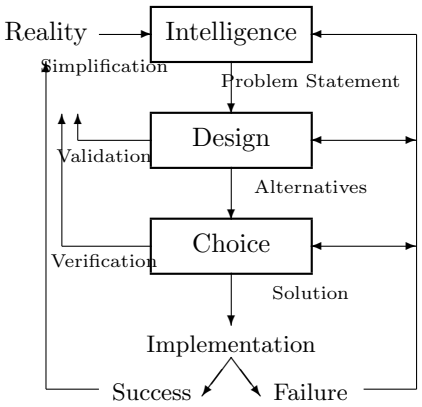

Figure 1: Decision making model.

outcome of the design phase is a set of alternative solutions and outcome of the choice phase is a selected solution.