Chapitre 1: Introduction aux décisions et processus décisionnels

1. Definition:

A decision is a reasoned **choice** amongst alternatives (Mallach 1994; Simon 1960).
Decision-making is the **process** of choosing among alternative courses of action, to attain a goal or goals (Turban 1995).

A decision is a choice made between 2 or more available alternatives. Decision Making is the process of choosing the best alternative for reaching objectives.
Decision making is the process of making choices by identifying a decision, gathering information, and assessing alternative resolutions.

2. Normative and descriptive theories

A normative decision theory is a theory about how decisions should be made, and a descriptive theory is a theory about how decisions are actually made.
A normative decision theory is a theory about how decisions should be made in order to be rational.

3. Decision Making Process

An influential subdivision of the decision process was proposed by Brim et al. (1962, p. 9). They divided the decision process into the following five steps:

1. Identification of the problem :
2. Obtaining necessary information
3. Production of possible solutions
4. Evaluation of such solutions
5. Selection of a strategy for performance

(They also included a sixth stage, implementation of the decision.)

What is a problem? A discrepancy between an existing and a desired state of affairs.

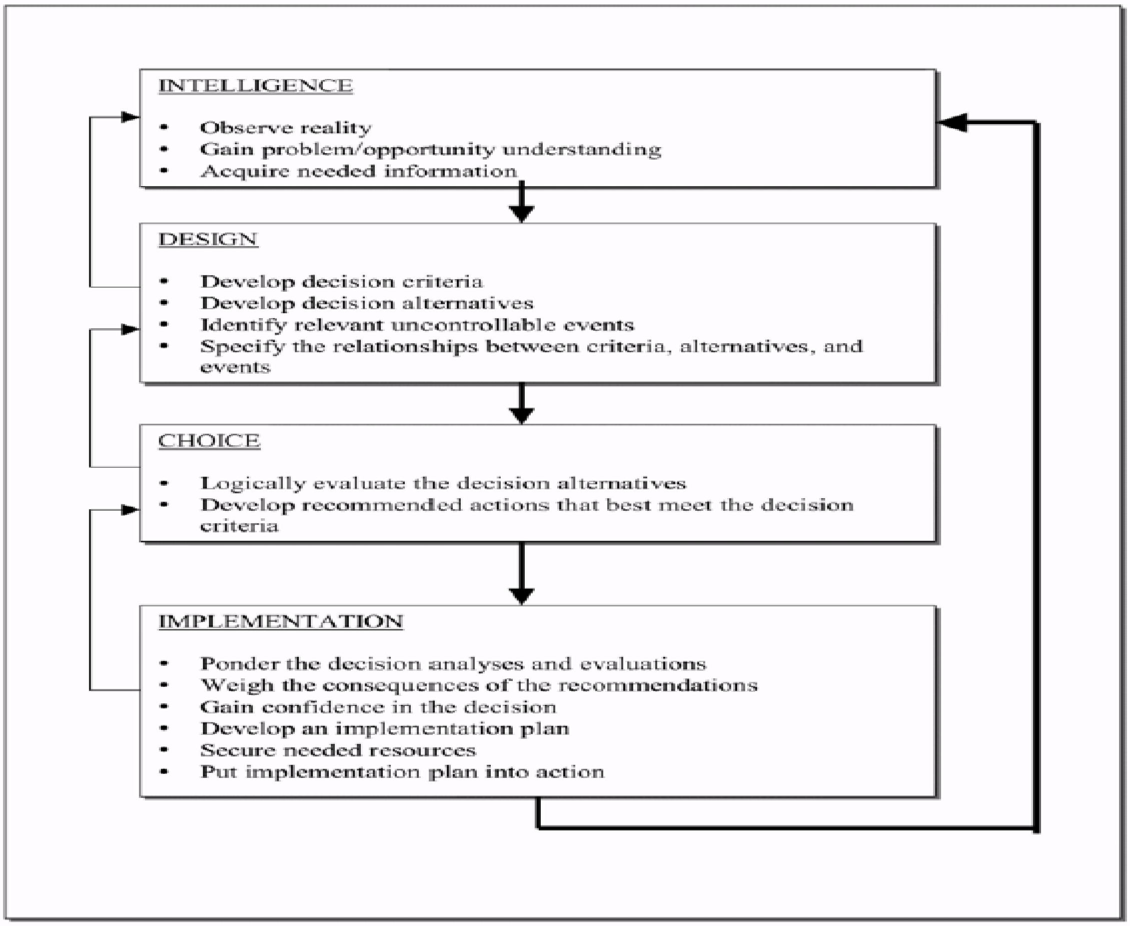
Simon (1960) proposed decision-making as a four-phase model: (a) **intelligence**, (b) **design**, (c) **choice** and (d) **implementation**.

Intelligence is comprised of the search for problems; **design** involves the development of alternatives; and **choice** consists of analyzing the alternatives and choosing one for implementation (Shim et al 2002). There is a continuous flow of activities from intelligence to design to choice, but at any phase there may be returned to a previous phase

a) The intelligence phase or problem detection and definition

The intelligence phase ends with a problem statement. The decision-maker decides what to decide or formulates the problem that needs a decision. This formulation is called a decision statement or problem statement (Mallach 1994) or the problem definition stage in Finlay's (1994) model. The intelligence phase may involve activities such as problem classification (the scope of the decision and its degree of structuredness), problem decomposition (Problems may be broken down in simpler sub-problems that could be solved individually) and determination of problem ownership

Figure 1: Decision Making Process



.

b) The design phase may involve a great deal of research to determine alternatives or available options that exists (Mallach 1994). Turban et al (2001) defines this as the stage where a model is constructed and validated and criteria set for the evaluation of potential solutions that are identified.

c) The choice phase: In the choice phase all alternatives are searched, evaluated and one chosen as recommended solution (Simon 1960). The solution is tested “on paper” and once the proposed solution seems feasible, the decision can be implemented (Turban et al 2001).

d) The implementation phase: If the proposed solution seems reasonable, it may be implemented. Successful implementation results in solving the original problem

After the final choice is implemented, the decision maker should observe the new reality and, where appropriate, follow through with intelligence, design, choice, and implementation.
Moreover, phase analyses may suggest the need for revisions at preceding phases. For example, analyses during choice may necessitate adjustments in the previous design. Such continuous monitoring and adjustment is similar to Simon's review phase.

4. Decision making conditions

Managers make problem-solving decisions under three different conditions (1) uncertainty, (2) certainty, and (3) risk

4.1. **Certainty** Decision-making under certainty assumes that complete information is available and that the outcome will be deterministic (one outcome for a criteria). This occurs most often with structured problems in short time horizons (up to one year).

4.2. **Decision under risk** also known as a probabilistic or stochastic decision situation.

- Probability of each of several possible outcomes occurring
- Risk analysis
- Calculate expected value of each alternative
- Select best expected value

4.3. **Uncertainty** In cases where decisions are made with uncertainty, there are several outcomes for each alternative. The probability of occurrence of the possible outcome is not known and cannot be estimated. This type is more difficult to evaluate.

- Several outcomes for each decision
- Probability of occurrence of each outcome unknown and cannot be estimated.
- Insufficient information

5. The scope of decision-making: Decision Levels

Three levels of decision have been identified:

5.1. **Strategic decisions** are the highest level. Here a decision concerns general direction, long term goals, It affects the company for an extended period of time. These decisions are the least structured and most imaginative; they are the most risky and of the most uncertain outcome, partly because they reach so far into the future and partly because they are of such importance.

5.2. **Tactical decisions** support strategic decisions. They tend to be medium range, medium significance, with moderate consequences.

5.3. **Operational decisions** are every day decisions, used to support tactical decisions. The tasks, resources and goals of these activities have already been set by other strategic or tactical decisions. They are often made with little thought and are structured. Their impact is immediate, short term, short range, and usually low cost. The consequences of a bad operational decision will be minimal, although a *series* of bad or sloppy operational decisions can cause harm. Lower management or non-managerial personnel are normally involved in operational decisions. Operational decisions can be preprogrammed, pre-made, or set out clearly in policy manuals.

6. Types of decisions

Decisions related to structured situations, are known as programmed decisions. Decisions related to unstructured situations, are known as nonprogrammed decisions .

Generally speaking, there are three types of problems to be solved by management:

6.1 **Structured**: Repetitive; definite procedure; have a high level of certainty; could even be called routine.

6.2 **Semi-structured**: One or more factors are not structured; the more unstructured, the higher the risk.

6.3 **Unstructured**: Unique; non-routine; has definite uncertainty; requires experience and judgment.

7. Decision-Making Models

7.1 **Rational decision making**

Rational decision making is a multi-step and linear process, designed for problem-solving. It has six steps (allmindtools.com/):

Step 1: Identify and define the problem:
The first step to make a rational decision is to identify and describe the problem by defining the current and desired states and defining the alternatives:
Identifying the cause of the problem, not the symptoms.
Step 2: Identify the criteria you will use to judge possible solutions
Outlining all the criteria ahead of time because those criteria will be a good guide to make a decision
Step3: weight established criteria: Decide how important each criterion is
Step 4: Generate list of alternatives
Define all possible options, no matter they are good or bad solutions. Evaluate those alternatives.
Step 5: Evaluate the alternatives:
At this stage, we want to evaluate the alternatives that we've identified using the criteria that we've identified in step2. This step may be lengthy depending on the number of criteria and the number of alternatives.

Step 6: Determining the optimal decision
There are four main assumptions behind the classical model:

- First is a clearly defined problem. The model assumes that the decision-maker has clearly set goals and knows what is expected from him.
- Next is a certain environment. The model further suggests that it is in the power of the decision-maker to eliminate any uncertainty that might impact the decision. As a result, there are no risks to account for.
- The third assumption is full information. The decision-maker is able to identify all alternatives available to him and to evaluate and rank them objectively.
- The final assumption is rational decisions. The decision-maker is believed to always be acting in the best interests of the organization.

Despite all its benefits, you may have noticed that this decision-making model involves a number of unrealistic assumptions. It assumes that people understand what decision is to be made, that they know all their available choices, that they have no perceptual biases, and that they want to make optimal decisions. Nobel Prize–winning economist Herbert Simon observed that while the rational decision-making model may be a helpful tool for working through problems, it doesn’t represent how decisions are frequently made within organizations. In fact, Simon argued that it didn’t even come close!

However, it's not the best model to use when you're under time constraints or in a fast-changing situation. It's also important to remember that you won't always have all the information you need to use this model. And, even if you do, going through the full process isn't efficient or necessary for some decisions.

7.2 **Non-Rational Models**

7.2.1 **Bounded rationality or "satisficing" decision-making model**

Instead of rigorously seeking the best possible decision, you're just looking for a "good enough" decision.
In the 1950s, an economist, Herbert Simon studied the actual behaviors of managerial decision makers. On the basis of his studies, Simon propounded the concept of bounded rationality. This concept suggests that the managers may not always be perfectly rational in making decisions.
In the 1950s, an economist, Herbert Simon studied the actual behaviors of managerial decision makers. On the basis of his studies, Simon propounded the concept of bounded rationality. This concept suggests that the managers may not always be perfectly rational in making decisions.

- Decision-makers may have inadequate information about the nature of the issue to be decided. They may also not possess enough information about possible alternatives and their strengths and weaknesses.

- The amount of information that can be gathered in regard to a particular decision is limited by time and cost factors.

- Decision-makers may overlook or ignore critical information because of their perceptions about the relative importance of various pieces of data.

- (iv)The degree to which decision-makers can determine optimal decisions is limited by the individual’s capacity and intelligence.

- The inability to remember large amounts of information is another factor that limits the ability of managers to make rational decisions.

Simon argues that instead of searching for the perfect or ideal decision, managers seek alternatives only until they identify one that looks satisfactory.

You can use bounded rationality when you don't have enough time or information to follow the full rational decision-making model.

7.2.2 **Intuitive decision-making model**

Intuitive decision-making ability is also known as 'sixth sense' and involves being able to gather information that other individuals may miss. It is the opposite of rational decision making, which is when individuals use analytics, facts, and a step-by-step process to come to a decision (Intuitive Decision Making in Business and Management, 2013).

When talking about intuition we are describing something that is known, perceived, understood or believed by instinct, feelings or nature without actual evidence, rather than by use of conscious thought, reason, or rational processes.

Researchers have found that an intuitive decision-making model yields good results when you're dealing with areas where you have a lot of expertise or experience. But going with your gut is less effective and efficient when you're in an unfamiliar circumstance.

7.2.3 **The Incremental Model**

Instead of making one huge leap towards solving a problem, the incremental model breaks down the decision-making process into small steps. The process of then moving between the steps is known as muddling through and is based on the combination of experience, intuition, guessing, and using different techniques. This model was developed by Charles Lindblom.

A small number of alternatives and consequences are considered at each stage of the decision-making process. As a result, the costs of making a decision are minimized. As each step is proposing only a small change; the immediate effect is minimal and usually not disruptive. Other benefits of the incremental model are its simplicity and flexibility. Because the difference between status quo and proposed solution at every stage is small, it's often easier to reach a consensus between different stakeholders, and conflict is avoided.

Let's also consider the drawbacks of this approach. Limiting the number of alternatives and consequences considered naturally creates a possibility of missing the best possible solution. Instead, decision-makers usually settle for an acceptable 'good enough' option, and the quality of the final decision lowers. It's often impossible to roll out a radical proposal using this approach, since the change at every stage has to be small. The incremental model will work only for situations where continuous decision-making and implementation are acceptable.

The incremental model is often used in the public sector, where significant changes are likely to cause public dispute, and in software development, where bite sized changes help to avoid big and costly mistakes.

1. Decision matrices or Decision Tables

A decision problem is characterized by

- Decision variables (alternatives)
- Uncontrollable variables (states of nature)
- Result variables (outcomes, consequence or resulting payoffs)

At the time the decision must be made the decision maker assumes that one of the columns represents the actual decision situation, but her or she does not know which column is the correct one.

	States of nature		
Alternatives	Sate1	State2	State n
Alternative 1	Outcome 11	Outcome 12	Outcome 1n
Alternatives 2	Outcome 21	Outcome 22	Outcome 2n
Alternative m	Outcome m1	Outcome m2	Outcome m3

The states of nature refer to future events, not under the control of the decision maker (factors that are beyond the control of the decision-maker), which may occur. States of nature should be defined so that they are **mutually exclusive** and **collectively exhaustive**.

EXAMPLE

A firm has two options for expanding production of a product:
(1) Construct a large plant; or (2) construct a small plant. Whether or not the firm expands, the future market for the product will be either favorable or unfavorable.

If a large plant is constructed and the market is favorable, then the result is a profit of $200,000.
If a large plant is constructed and the market is unfavorable, then the result is a loss of $180,000.
If a small plant is constructed and the market is favorable, then the result is a profit of $100,000.
If a small plant is constructed and the market is unfavorable, then the result is a loss of $20,000.
Of course, the firm may also choose to “do nothing”, which produces no profit or loss.

	States of nature	
Alternatives	Favorable Market	Unfavorable Market
Construct large plant	$200.000	-$180.000
Construct small plant	$100.000	-$20.000
Do nothing	$0	$0

Assume that the experts estimate the chance of favorable market at 60%, and the chance of unfavorable market at 40%. The decision table is then rewritten with the known probabilities (see next table).

	States of nature	
Alternatives	Favorable Market 0.5	Unfavorable Market 0.5
Construct large plant	$200.000	-$180.000
Construct small plant	$100.000	-$20.000
Do nothing	$0	$0

In summary, the standard representation of a decision consists of
(1) a utility matrix, and (2) some information about to which degree the various states of nature in that matrix are supposed to obtain. Hence, in the case of decision-making under risk, the standard representation includes a probability assignment to each of the states of nature (i.e., to each column in the matrix).

A simple case of multiple attributes decision making. A decision situation where alternatives are evaluated with several sometimes conflicting goals is shown in next table

	Mutiple goals (criteria)		
Alternatives	Price	Maintenance	Floor
Apartment 1	100	20	1
Apartment 2	120	10	2

This situation is under certainty because only one possible outcome is projected for each alternative. A more complex case of uncertainty or risk can be considered.

Decision making rules

In this section we will be studying through the example bellow, the different decision rules under different decision conditions, i.e. Certainty uncertainty and risk.

Example

A grocer solves a problem of how much pastry to order every day. His profit depends on a demand that can be low, moderate, or high. Values of the profit per day (in $) for these situations and for small, medium or large order are shown in Table below.

Demand Order ↓	Low	Moderate	High
Small	50	50	50
Medium	42	52	52
Large	34	44	54

Table 2.2 "Payoff Table for Order Planning"

1) Under complete certainty,

In the above grocer's decision problem, suppose that it is known with certainty that demand will be low.

What's the alternative chosen by the decision maker?

2) Under complete uncertainty,

2.1 Under the **maximax rule** what's the best alternative?

2.2 Under the **maximin rule** (Wald criterion) what's the best alternative?

2.3 Under **α index rule** (Hurwicz α-criterion) with α=0.70, what's the best alternative?

2.4 Under minimax **regret rule** (Savage criterion), what's the best alternative?

2.5 Under the **principle of insufficient reason** (Laplace criterion), what's the best alternative?

3) Under Risk

Suppose that the grocer can assign probabilities of low, moderate and high demand probabilities, 0.3, 0.5, and 0.2, respectively.

3.1 Under **expected monetary value** criterion (EMVor EV), what's the best alternative?

3.2 Under **expected opportunity loss** (EOL), what's the best alternative?

3.3 Under **maximum - likelihood decision** criterion, what's the best alternative?

4) What's **the expected value of perfect information**?

Response

1) Under complete certainty

In the above grocer´s decision problem, suppose that it is known with certainty that demand will be low. What's the alternative chosen by the decision maker?

1. The highest profit for low demand is $50 (see Table 2.2) and therefore the small order should be elected.

2) Under complete uncertainty

2.1 Under the maximax rule

2.1 The best overall profit is $54 in the third row. Hence, the maximax rule leads to the large order (the grocer hopes that the demand will be high).

2.2 Under the maximin rule (Wald criterion)

2.2 The smallest numbers in the rows are 50, 42, 34. Since 50 is the largest, the low order should be chosen (if order is low, the $50 grocer's profit is guaranteed).

2.3 Under α-index rule (Hurwicz -criterion) with α=0.7

2.3 The weighted average (WA) of the largest and the smallest profit for each size of the order has the following values:
WA (small) = 0.7* 50 + 0.3 * 50 = 50
WA (medium) = 0.7* 52 + 0.3 * 42 = 49
WA (large) = 0.7* 54 + 0.3 *34 = 48
Maximizing the weighted average of the largest and the smallest profit, the small order should be selected.

2.4 Under minimax regret rule (Savage criterion)

2.4

Demand Order ↓	Low	Moderate	High	Maximum Loss
Small	0	2	4	4
Medium	8	0	2	8
Large	16	8	0	16

"Regret Table for Order Planning"

In the first column of the payoff matrix, the largest number is 50, so each of the three numbers in that column must be subtracted from 50. In the second column, we must subtract each payoff from 52 and in the third column from 54. The results of these calculations are summarized in Table 2.4. A column with the maximum loss in each row is added to this table.

This decision rule is arguably the most defensible of the various decision rules we have considered so far. But it can also lead to some poor decisions if just one more option is added to the problem. For example, suppose a third attractive parcel of land suddenly becomes available in either the East or West suburb. Depending on the values assigned to this third parcel, it is possible, according to the conditions of the minimax regret rule, that even if the newly available third parcel is not chosen, simply applying the rule to this new situation could actually change the original decision. So changes in the situation can lead to some inconsistent results, which can be quite troubling and problematic for the decision-maker.

2.5 Under the principle of insufficient reason (Laplace criterion)

2.5 The principle of insufficient reason (Laplace criterion) assumes that all states of nature are equally likely. Under this assumption, the decision maker can compute the average payoff for each row (the sum of the possible consequences of each alternative is divided by the number of states of nature) and, then, select the alternative that has the highest row average. This procedure is illustrated by the following calculations with the data in Table 2.2.
EMV (small) = (50 + 50 + 50)/3 = 50
EMV (medium) = (42 + 52 + 52)/3 = 48 2/3
EMV (large) = (34 + 44 + 54)/3 = 44
Since the profits at the small order have the highest average, that order should be realized.

3) under Risk

Suppose that the grocer can assign probabilities of low, moderate and high demand probabilities, 0.3, 0.5, and 0.2, respectively.

3.1 Under expected monetary value criterion (EMVor EV)

3.1 The EMV for various sizes of the order are as follows.
EMV (small) = 0.3*50 + 0.5*50 + 0.2*50 = 50
EMV (medium) = 0.3*42 + 0.5*52 + 0.2*52 = 49
EMV (large) = 0.3*34 + 0.5*44 + 0.2*54 = 43
Therefore, in accordance with the EMV criterion, the small order should be chosen.

3.2 Under expected opportunity loss (EOL), what's the best alternative?

3.2 We will use this procedure in the regret matrix shown in Table 2.4. We will recall this table. Supposing that the probabilities of various sizes of the demand are 0.3, 0.5, 0.2, we can determine the EOL for each size of the order.
EOL (small) = 0.3*0 + 0.5*2 + 0.2*4 = 1.8
EOL (medium) = 0.3*8 + 0.5*0 + 0.2*2 = 2.8
EOL (large) = 0.3*16 + 0.5*8 + 0.2*0 = 8.8
Since the small order is connected with the smallest EOL, it is the best alternative.

3. 3 under maximum - likelihood decision criterion

3.3 The maximum - likelihood decision criterion. According to this criterion, we consider only the state of nature with the highest probability and choose the best alternative for that state of nature.
If we suppose in the decision problem given in Table 2.2 that the probabilities of various sizes of the demand are 0.3, 0.5, 0.2, the moderate demand is most likely. Under this situation, the medium order is the best.
Since the maximum-likelihood criterion takes only one uncertain state of nature into account it may lead to bad decisions.
The expected value approach (the calculation of the EMV or the EOL) is particularly useful for decision making when a number of similar decisions must be made; it is a "long-run" approach. For one-shot decisions, especially major ones, approaches for decision making under uncertainty may be preferable.

4) What's the expected value of perfect information?

4) Expected Value of Perfect Information (EVPI)

The expected value of perfect information (EVPI) represents the increase of the best expected payoff in consequence of obtaining a free, perfect prediction. It can be interpreted as an upper bound on the amount of money the decision maker would be justified in spending to obtain perfect information.
The EVPI is equal to the difference between the expected payoff under certainty (EPC), hat is with the perfect information, and the best expected payoff without the perfect information. The following formulas hold:

EVPI = EPC – max(EMV) for a maximization criterion
EVPI = min(EMV) – EPC for a minimization criterion

Here is an important relationship between the EVPI and the EOL.

The EVPI is equal to the expected opportunity loss for the best alternative, i. e. to the minimum value of the EOL computed for each alternative.

The mentioned relationship can be explained in this way: The perfect information **should reduce the opportunity loss that exists under uncertainty due to imperfect information to zero**. Hence, the expected opportunity loss of the optimal alternative measures the EVPI and conversely, the EVPI is a measure of opportunities forgone.
In this sense, if the EVPI is large, it should be a signal to the decision maker to seek other alternatives.
We will determine the EVPI in the grocer's decision problem.

The best payoff under each state of nature is 50, 52, 54.
The probabilities of these states are 0.3, 0.5, 0.2.
The expected payoff under certainty is :
EPC = 0.3*50 + 0.5*52 + 0.2*54 = 51.8.
The largest expected payoff without the perfect information, as computed, is max(EMV) = 50.
Hence,
EVPI = EPC – max(EMV) = 51.8 - 50 = 1.8
The value 1.8 is equal to the lowest expected regret
A useful check on computations is provided by the following identity:
EMV (of any alternative) + EOL (for the same alternative) = EPC

2. The concept of utility (INVESTOPEDIA Updated Jan 30, 2020)

Utility is a term in economics that refers to the **total satisfaction** (pleasure or happiness) received from consuming a good or service or from working. Economic theories based on rational choice usually assume that consumers will strive to maximize their utility.

There are many theories that describe the level of satisfaction; however, **cardinal** utility theory was applied by Prof. Marshall) and **ordinal** utility (theory was applied by Prof. J R Hicks) are the two predominant theories of utility.

- Cardinal utility believes in measuring the satisfaction level in **utils (**the quantitative measurement of satisfaction, a specific good or service generates).
- Ordinal utility believes that the satisfaction level cannot be evaluated; however, it can be levelled.
- Cardinal utility gives a value of utility to different options. Ordinal utility just ranks in terms of preference.

Utility of a payoff is a measure of the personal satisfaction associated with that payoff. It is evident that the same amount of money has not the same value (for example, the value of a dollar added to $10 is larger than that of one added to $1,000).

For example, for a particular decision maker — say, one who has no money — the utility of $0 might be 0, the utility of $1 million might be 1000, and the utility of $3 million might be 1500.

Economic utility can decline as the supply of a service or good increases (utils can decrease as the number of products or services consumed increases). Marginal utility is the utility gained by consuming an additional unit of a service or good. The first slice of pizza may yield 10 utils, but as more pizza is consumed, the utils may decrease as people become full.

If we consider how an individual experiences utility when consuming a product, ice cream, we can make some important observations how total utility changes as the consumption of a good increases.

Quantity	Utility Total	Marginal Utility
1	10	10
2	18	8
3	24	6
4	28	4
5	30	2
6	30	0
7	28	-2

As can be seen, total utility increases with increasing quantity of a single item until marginal utility = 0; thereafter, total utility declines when marginal utility becomes negative.

Utility is totally different from **usefulness** and morality. It means a good possesses utility even when it may not be useful or does not possess any moral and ethical importance. For instance. A cigarette has utility to the smoker but it is harmful to his health. However, demand for a commodity depends on its utility rather than its usefulness.

2.1 **Utility function**

A **utility function** is a representation to define individual preferences for goods or services beyond the explicit monetary value of those goods or services. In other words, it is a calculation for how much someone desires something, and it is relative.

A utility function U(x) represents a preference relation' E.g. suppose U(x) = 6 and U(y) = 2. As U(x)>U(y), Then the bundle x is strictly preferred to the bundle y.

Fundamental Assumptions about Individual Preferences

Completeness: We say preferences are complete when a consumer can always say one of the following about two bundles: A is preferred to B, B is preferred to A or A is equally good as B

Transitivity: We say preferences are transitive if they are internally consistent: if A is preferred to B and B is preferred to C, then it must be that A is preferred to C.

More is Better: If bundle A represents more of at least one good, and no less of any other good, than bundle B, then A is preferred to B.

2.2 **Expected Utility**

Expected utility theory is used as a tool for analyzing situations where individuals must make a decision without knowing which outcomes may result from that decision, i.e., decision making under uncertainty.

When faced with a number of different choices, expected utility theory recommends that you calculate the expected utility of each choice and then choose the one with highest expected utility. The expected utility is calculated by taking the weighted average of all possible outcomes under certain circumstances, with the weights being assigned by the likelihood, or probability, that any particular event will occur.

Suppose you may choose between (A) receiving a million dollars *for sure*, and (B) a 50% chance of winning either $3 million or nothing.

The (EMV) of choice A is (1)($1 million) = $1 million.
The EMV of choice B is (0.5)($3 million) + (0.5)($0) = $1.5 million.

Choice B has a higher expected monetary value, and yet many people would prefer the guaranteed million. Why?

Let, for a particular decision maker — say, one who has no money — the utility of $0 might be 0, the utility of $1 million might be 1000, and the utility of $3 million might be

Thus, the ***expected utility*** (EU) of choice A is, for this decision maker, (1)(1000) = 1000.
Meanwhile, the EU of choice B is (0.5)(1500) + (0.5)(0) = 750.

The expected utility of choice A is greater than that of choice B, even though choice B has a greater expected monetary value.

For many people, the difference between having $0 and $1 million is ***subjectively*** much larger than the difference between having $1 million and $3 million, even if the latter difference is larger in dollars.

Example 1

Consider again the decision about whether to take a cheap airline or a more reliable airline, where the cheap airline is cheaper, but it performs badly in bad weather.

	Good weather	Bad weather
Cheap Airline	10	0
Reliable Airline	6	5

Decision Table

EU(Cheap Airline) = 0.8 * 10 + 0.2 * 0= 8 + 0= 8
EU(Reliable Airline) = 0.8 * 6 + 0.2 * 5 = 4.8 + 1= 5.8

The cheap airline has a higher expected utility, so it is what you should take.

Risk attitudes

Given A lottery ticket that pays out $10 with probability .5 and $0 otherwise, or A lottery ticket that pays out $3 with probability 1.Usually, people do not simply go by expected value

- An agent is risk-neutral if she only cares about the expected value of the lottery ticket
- An agent is risk-averse if she always prefers the expected value of the lottery ticket to the lottery ticket - Most people are like this
- An agent is risk-seeking if she always prefers the lottery ticket to the expected value of the lottery ticket

Example 2

Demand Order ↓	Low	Moderate	High
Small	50	50	50
Medium	42	52	52
Large	34	44	54

Table 2.2 "Payoff Table for Order Planning"

Suppose that the grocer can assign probabilities of low, moderate and high demand probabilities, 0.3, 0.5, and 0.2, respectively.

Under **expected utility** criterion what's the best alternative?
Suppose that the grocer expressed the utilities of the profit values with the numbers shown in Table bellow

Profit	34	42	44	50	52	54
Utility	0	0.7	0.8	0.9	0.95	1

"Utility Values of Profit"

Response

Under expected utility criterion what's the best alternative?

Suppose that the grocer expressed the utilities of the profit values with the numbers shown in Table bellow

Profit	34	42	44	50	52	54
Utility	0	0.7	0.8	0.9	0.95	1

"Utility Values of Profit"

If we translate the monetary values in a payoff table to their utilities, we can replace the EMV criterion by the expected utility criterion. We calculate the expected utility (EU) for each alternative and choose the alternative with the highest EU.

If the probabilities of low, moderate, and high demand are 0.3, 0.5, 0.2, respectively, expected utilities of the alternatives have the following values:

EU (small) = 0.9

EU (medium) = 0.3*0.7 + 0.5*0.95 + 0.2*0.95 = 0.875

EU (large) = 0.3*0 + 0.5*0.8 + 0.2*1 = 0.6

The greatest expected utility is connected with the small order and therefore this order should be realized.

Dominance Principle

The simplest rule we can use for decision making is never choose dominated options. There is a stronger and a weaker version of this rule.

An option A strongly dominated another option B if in every state, A leads to better outcomes than B. A weakly dominates B if in every state, A leads to at least as good an outcome as B, and in some states it leads to better outcomes.

Consider, for example, choosing whether to watch football or work on a term paper. Imagine that you'll do very badly on the term paper if you leave it to the last minute. And imagine that the term paper is vitally important for something that matters to your future. Then we might set up the decision table as follows.

	Your team wins	Your team loses
Watch football	2	1
Work on paper	4	3

If your team wins, you are better off working on the paper, since 4 > 2. And if your team loses, you are better off working on the paper, since 3 > 1. So either way you are better off working on the paper. So you should work on the paper.