# CERTIFIED PUBLIC ACCOUNTANT

# FOUNDATION LEVEL 1 EXAMINATION

## F1.1: BUSINESS MATHEMATICS AND QUANTITATIVE METHODS

## DATE: THURSDAY 29, FEBRUARY 2024

## MARKING GUIDE AND MODEL ANSWERS

**QUESTION ONE**

**Buryohe Company Limited (BCL):**

**Marking Guide**

| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **a (i)** | Maximax Criterion: | | |
| | Decision for Maximax criterion | 1 | |
| | Reason for the decision of Maximax criterion | 1 | 2 |
| **a (ii)** | Minimax Criterion: | | |
| | Calculation for the regrets under high demand (0.5*3) | 1.5 | |
| | Calculation for the regrets under Moderate demand (0.5*3) | 1.5 | |
| | Calculation for the regrets under Low demand (0.5*3) | 1.5 | |
| | Identification of maximum regrets (0.5*3) | 1.5 | |
| | Decision for Minimax criterion | 0.5 | |
| | Reason for the decision of Minimax criterion | 0.5 | 7 |
| **a (iii)** | Hurwitz Criterion: | | |
| | Computation for the payoff of each product (1*3) | 3 | |
| | Decision for Hurwitz criterion | 0.5 | |
| | Reason for the decision of Hurwitz criterion | 0.5 | 4 |
| **b** | Expected Monetary Value (EMV): | | |
| | Computation for the EMV of each product (1*3) | 3 | |
| | Decision for Expected Monetary Value | 0.5 | |
| | Reason for the decision of EMV | 0.5 | 4 |
| **c** | Expected Value of Perfect Information (EVPI): | | |
| | Formula | 1 | |
| | Calculation of expected value under certainty | 1 | |
| | Calculation of EVPI | 1 | 3 |
| | **Total Marks** | | **20** |

**Model Answers**

a) Determination of the best product through the following criteria

i) Maximax criterion

| | Demand Conditions (FRW) | | | Maximax |
|---|---|---|---|---|
| Products | High Demand | Moderate Demand | Low Demand | Maximum |
| Ineza Juice | 40,000,000 | 70,000,000 | 20,000,000 | **70,000,000** |
| Kera Juice | 50,000,000 | 30,000,000 | 10,000,000 | 50,000,000 |
| Kabuto Juice | 45,000,000 | 35,000,000 | (15,000,000) | 45,000,000 |

The decision under Maximax criterion is to choose Ineza Juice because FRW 70,000,000 is the maximum of the maximum payoffs from the table above.

ii) Minimax criterion

**Regret Table**

| | Demand Conditions (FRW) | | | |
|---|---|---|---|---|
| Products | High Demand | Moderate Demand | Low Demand | Maximum |
| Ineza Juice | 10,000,000 | 0 | 0 | 10,000,000 |
| **Kera Juice** | 0 | 40,000,000 | 10,000,000 | **40,000,000** |
| Kabuto Juice | 5,000,000 | 35,000,000 | 35,000,000 | 35,000,000 |

The decision under Minimax criterion is to choose Kera Juice because FRW 40,000,000 is the maximum of the minimum regrets as shown from the table above.

iii) Hurwitz criterion (Alpha = 0.6)

| Formula | Payoff = α*(Maximum value) + (1 - α) *(Minimum value) | |
|---|---|---|
| **Ineza Juice** | Payoff= 0.6(70,000,000) + [(1-0.6) *20,000,000] | Maximum Payoff |
| | Payoff= 42,000,000 + 8,000,000 = **FRW 50,000,000** | **FRW 50,000,000** |
| | | |
| Kera Juice | Payoff= 0.6(50,000,000) + [0.4) *10,000,000] | |
| | Payoff= 30,000,000 + 4,000,000 = **FRW 34,000,000** | |
| | | |
| Kabuto Juice | Payoff= 0.6(45,000,000) + [0.4) *-15,000,000] | |
| | Payoff= 27,000,000 - 6,000,000 = **FRW 21,000,000** | |
| | | |

The decision under Hurwitz criterion is to choose Ineza Juice because FRW 50,000,000 is the maximum payoff as shown from the table above.

b) Expected Monetary Value (EMV)

| | Demand Conditions (FRW) | | |
|---|---|---|---|
| Products | High Demand | Moderate Demand | Low Demand |
| Ineza Juice | 40,000,000 | 70,000,000 | 20,000,000 |
| Probability | 0.40 | 0.50 | 0.10 |
| Kera Juice | 50,000,000 | 30,000,000 | 10,000,000 |
| Probability | 0.60 | 0.30 | 0.10 |
| Kabuto Juice | 45,000,000 | 35,000,000 | (15,000,000) |
| Probability | 0.50 | 0.30 | 0.20 |

Computation

| Formula | EMV =Summation of the product of outcome and probability | Maximum EMV |
|---|---|---|
| **Ineza Juice** | EMV = (40,000,000*0.40) + (70,000,000*0.50) +(20,000,000*0.10) | |
| | EMV = 16,000,000 + 35,000,000 + 2,000,000 = **FRW 53,000,000** | **FRW 53,000,000** |
| | | |
| Kera Juice | EMV = (50,000,000*0.60) + (30,000,000*0.30) +(10,000,000*0.10) | |
| | EMV = 30,000,000 + 9,000,000 + 1,000,000 = **FRW 40,000,000** | |
| | | |
| Kabuto Juice | EMV = (45,000,000*0.40) + (35,000,000*0.50) +(-15,000,000*0.10) | |
| | EMV = 18,000,000 + 17,500,000 - 1,500,000 = **FRW 34,000,000** | |

The decision under Expected Monetary Value is to choose Ineza Juice because FRW 53,000,000 is the maximum expected monetary value as shown from the table above.

c) Expected Value of Perfect Information (EVPI)

EVPI = Expected value under certainty - Expected value under risk

Expected value under certainty = (50,000,000*0.60) + (70,000,000*0.5) + (20,000,000*0.10)

Expected value under certainty = 30,000,000 + 35,000,000 + 2,000,000 = FRW 67,000,000

Expected value under risk is the maximum expected monetary value which is FRW 53,000,000

Expected Value of Perfect Information = FRW 67,000,000 - FRW 53,000,000 = **FRW 14,000,000**

**QUESTION TWO**

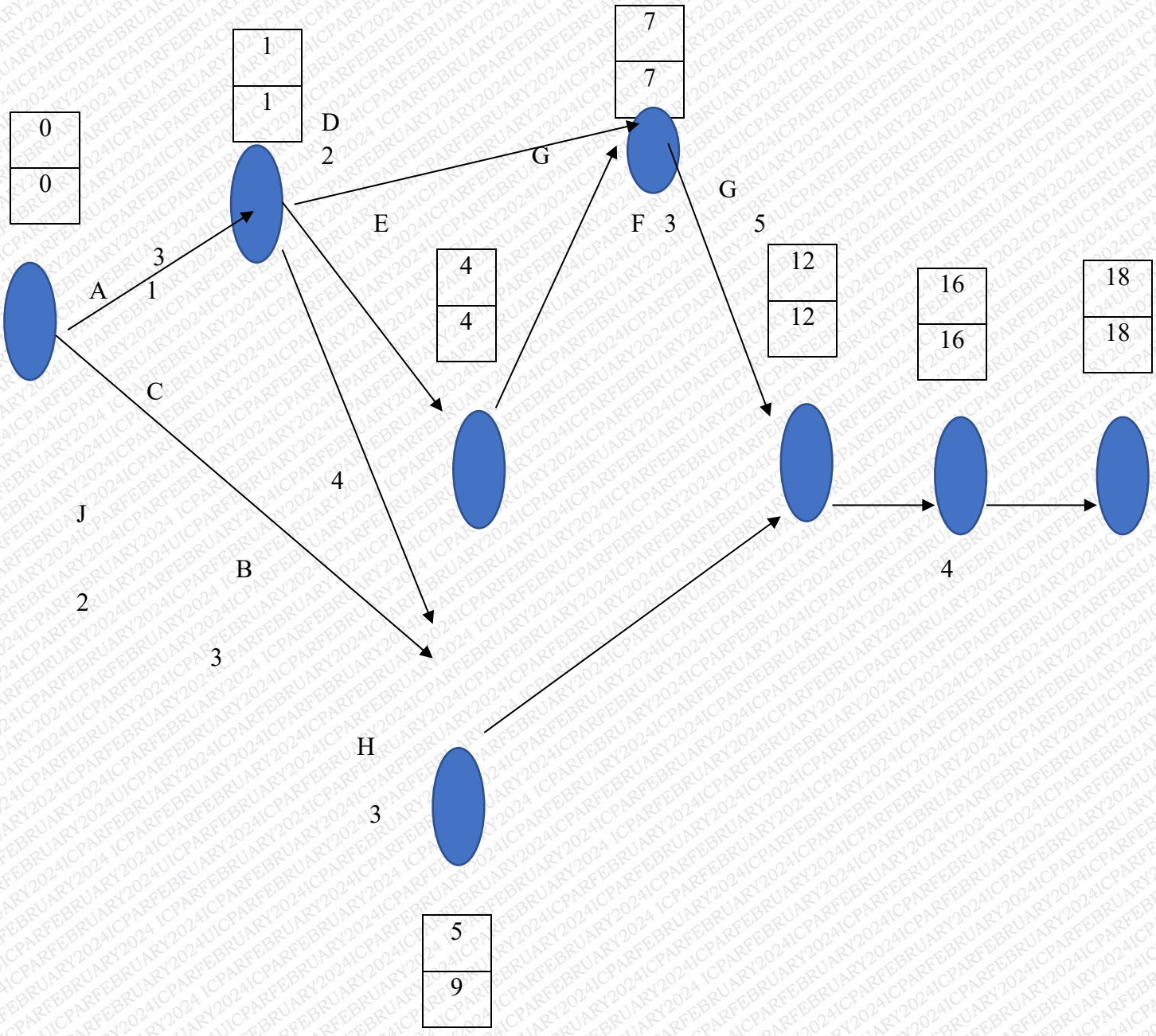
**Girinzu Company Limited:**

**Marking Guide**

| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **a** | Network Diagram: | | |
| | Each correct activity drawn and labeled (0.5*10) | | 5 |
| **b** | Critical path and project duration: | | |
| | Identification of the critical path | 1 | |
| | Calculation of the project duration | 1 | 2 |
| **c** | Total Floats for B, C, D, and H Activities: | | |
| | Formula for total float | 1 | |
| | Calculation of total float for activity B | 1 | |
| | Calculation of total float for activity C | 1 | |
| | Calculation of total float for activity D | 1 | |
| | Calculation of total float for activity H | 1 | 5 |
| **d** | Rules for drawing a network diagram: | | |
| | Each correct rule explained (1*4) | | 4 |
| **e** | Advantages of network analysis: | | |
| | Each correct advantage explained (1*4) | | 4 |
| | **Total Marks** | | **20** |

**Model Answers**

**a)** Network diagram



| Earliest Start Time (EST) |
|---|
| Latest Start Time (LST) |

Or

| Earliest Tail Time (ETT) |
|---|
| Latest Head Time (LHT) |

**b)** Critical path is **A – E – F – G – I – J**
Project Duration is **18 weeks**

**c) Floats of B, C, D, H**
Total Float = Latest Finish Time (LFT) – Earliest Start Time (EST) – Activity Duration
Or
Total Float = Latest Head Time (LHT) – Earliest Tail Time (ETT) – Activity Duration.

For Activity B, the duration is 3 weeks, LFT is 9 weeks, EST is 0 weeks
**Total Float = 9 weeks - 0 weeks - 3 weeks = 6 weeks**

For Activity C, the duration is 4 weeks, LFT is 9 weeks, EST is 1 weeks
**Total Float = 9 weeks - 1 week - 4 weeks = 4 weeks**

For Activity D, the duration is 2 weeks, LFT is 7 weeks, EST is 1 weeks
**Total Float = 7 weeks - 1 week - 2 weeks = 4 weeks**

For Activity H, the duration is 3 weeks, LFT is 12 weeks, EST is 5 weeks
**Total Float = 12 weeks - 5 week - 3 weeks = 4 weeks**

**d) Rules of drawing a network diagram**

i) Each activity is represented by one and only one arrow. This implies that no single activity can be represented twice in the network.
ii) Not two activities can be identified by the same end events. This implies that there must be no loops in the network.
iii) Only one activity may connect any two nodes. This rule is necessary so that an activity can be specified by giving the numbers of its beginning and ending nodes.
iv) Every node must have at least one activity preceding it and at least one activity following it except for the very beginning and at the very end of the network. The beginning node has no activities before it and the ending node has no activities following it.

v) Use dummies freely in rough draft but final network should not have any redundant dummies.

vi) Arrows pointing in opposite direction must be avoided.

vii) Arrows should be kept straight and not curved or bent. And avoid arrows which cross each other.

**e) Advantages of network analysis**

i) Network analysis helps to determine the objective of the project.

ii) The method enforces planning, because data from many sources must be collected and collated before being logically put together to give the network.

iii) Areas of responsibility are specifically defined, the relationship between activities is clearly shown and the network reveals the interactions of all participants.

iv) The technique provides for simple communication and, therefore, easy to apply because the network diagrams and charts are easily understood by non-specialists.

v) Control is simplified, because network analysis permits the use of management by exception, where by the management need act only when the situation is out of control.

vi) The technique is equally applicable to large-scale and small-scale operations.

vii) The system lends itself easily to computers and many computer manufacturers provide standard packages of network analysis routines with their equipment.

**QUESTION THREE**

**Marking scheme:**

| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **a** | Presentation of probability distribution tables: | | |
| | Each value in the table for Quantitative methods (1*6) | 6 | |
| | Labeling titles in the table – random variable and probability (1*2) | 2 | 8 |
| **b** | Expected values: | | |
| | Formula for expected value | 1 | |
| | Calculation of Expected Value | 2 | 3 |
| **c** | Variance: | | |
| | Formula for variance | 1 | |
| | Calculation of variance | 3 | 4 |
| **d** | Standard deviation: | | |
| | Formula for standard deviation | 1 | |
| | Calculation of standard deviation | 1 | 2 |
| **e** | Assumptions of binomial probability distribution (1*3) | | 3 |
| | **Total Marks** | | **20** |

**Model Answers**

**a) Presentation of probability distribution tables for both papers**

Quantitative Methods

| Random Variable (x) | Probability P(x) |
|---|---|
| 0 | 10/50 = 0.20 |
| 1 | 12/50 = 0.24 |
| 2 | 10/50 = 0.20 |
| 3 | 8/50 = 0.16 |
| 4 | 6/50 = 0.12 |
| 5 | 4/50 = 0.08 |
| | |

**b) Calculation of expected value**

Expected value =μ= Σ[x*P(x)]

**Expected Value = (0*0.20) + (1*0.24) + (2*0.20) + (3*0.16) + (4*0.12) + (5*0.08)**

**Expected Value = 0 + 0.24 + 0.40 + 0.48 + 0.48 + 0.40 = 2.00**

**c) Calculation of variances**

Variance = $\Sigma(x - \mu)^2P(x)$

Variance = $[((0 – 2)^20.20) + [((1 – 2)^20.24) + [((2– 2)^20.20) + [((3– 2)^20.16) + [((4 – 2)^20.12 + [((5 – 2)^20.08)$

Variance = [(4 * 0.20) + (1 * 0.24) + (0 * 0.20) + (1 * 0.16) + (4 * 0.12 + (9 * 0.08)

Variance = 0.80 + 0.24 + 0 + 0.16 + 0.48 + 0.72 = 2.4

**d) Calculation of standard deviation**

Standard Deviation = $\sqrt{variance} = \sqrt{\Sigma(x - \mu)2P(x)}$

Standard Deviation for Quantitative Methods = $\sqrt{2.4}$ = 1.549

**e) Assumptions of binomial probability distribution**

- Fixed number of trials, i.e. sample size represented as n.
- Each trial has two possible outcomes, a “success” and a “failure”.
- Probability of success indicated as p (and thus: Probability of failure as (1–p), for all trials.
- The trials are independent, which means that the outcome of one trial does not affect the outcomes of any other trials.

**QUESTION FOUR**

**Marking guide**

| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **a (i)** | Time Series Decomposition: | | |
| | Definition of time series decomposition | | 1 |
| **a (ii)** | Computation of trend component from times series equation | | 0.5 |
| **a (iii)** | Centred Moving Trend Values: | | |
| | Computation of 4 Quarterly Moving Averages (0.5*9) | 4.5 | |
| | Computation of 4 centered moving Averages (0.5*8) | 4.0 | 8.5 |
| **b (i)** | Branches of statistics: | | |
| | Identification of each branch (1*2) | 2 | |
| | Explanation of each branch (1*2) | 2 | 4 |
| **b (ii)** | Application of statistics: | | |
| | Statement of each application (1*3) | 3 | |
| | Explanation of each application (1*3) | 3 | 6 |
| | **Total Marks** | | **20** |

**Model Answers**

a) i) Times series decomposition is the separation of the overall series into basic components that are more likely to have recognizable and more predictable patterns. These components can be projected in the future and be combined to form a forecast. Basically, there are four components: trend, cyclic, seasonal and random irregular). Decompositions assume that these components act independently. It is also assumed that what caused them to can in the past will continue to operate in the same way even in the future.

The time series decomposition can be used to separate or decompose a time series into trend, seasonal and irregular components. Decomposition method can be used for forecasting and also to get a better understanding of the time series. Many business and government agencies use time series decomposition to create de - seasonalized time series.

ii) Trend component can be decomposed under multiplicative model by dividing the time series values by the other component.

Trend component = Time series/ (Seasonal variation*cyclic variation*irregular variation)

iii) Trend values from 4 centred moving averages

| | Quarter | Coffee Production (thousand tons) | 4 Quarterly Moving Totals | 4 Quarterly Moving Averages | 4 Centred Moving Averages |
|---|---|---|---|---|---|
| 2021 | 1 | 97 | | - | - |
| | | | | | |
| | 2 | 125 | | - | - |
| | | | 472 | 118 | |
| | 3 | 137 | | | 118.875 |
| | | | 479 | 119.75 | |
| | 4 | 113 | | | 121.125 |
| | | | 490 | 122.5 | |
| 2022 | 1 | 104 | | | 123.750 |
| | | | 500 | 125 | |
| | 2 | 136 | | | 127.000 |
| | | | 516 | 129 | |
| | 3 | 147 | | | 130.500 |
| | | | 528 | 132 | |
| | 4 | 129 | | | 131.500 |
| | | | 524 | 131 | |
| 2023 | 1 | 116 | | | 130.750 |
| | | | 522 | 130.5 | |
| | 2 | 132 | | | 130.000 |
| | | | 518 | 129.5 | |
| | 3 | 145 | | | |
| | | | | | |
| | 4 | 125 | | | |

b) i) **Branches of statistics**

1. Descriptive statistics: This is a branch of statistics which deals with methods of collection of data, its presentation and organization in various forms, such as distribution tables, graphs (e.g., Ogive, Lorenz curves, etc.), diagrams (e.g., pie charts) and finding measures of central tendency and measures of dispersion or spread which are used in the description of data. Managers and CEOs make use of descriptive statistics in presenting their annual reports, financial accounts and bank statements. Descriptive statistics is used to present the data in an understandable way, so that a meaningful description can be made.

2. Inferential or predictive statistics: This is a branch of statistics which deals with techniques used for analysis of data, making estimates that lead to predictions and drawing conclusions or inferences from limited information taken on sample basis and testing the reliability of the estimates or predictions.
Inferential statistics is used to make comparisons or predictions about a larger group, known as population, using information gathered about a small part of that population called a sample.

ii) **Applications of statistics**
**Applications**

- Statistics plays an important role in administration. Statistical data is widely used in making administrative decisions. Every administrator must have sets of program and policies which are formulated in order to meet the targeted objective plans. These plans depend on the correct and sound statistical data. Therefore, statistics is used as a tool for planning.
- Statistics is vital in economics. Statistics is very vital in developing and proving the laws and principles of economics. Knowledge of statistics is very useful in assessing and understanding the economic terminologies and problems, such as economic growth. Inflation rate, population growth rates, unemployment, supply and demand and National Income, that is, GDP, GNP, income per capita.
- Statistics is essential in business. For the smooth operation of a business, statistical data is very useful. It expresses facts in a definite form and simplifies the complex nature of business. Statistics helps the business people to plan according to market demand, that is, taste of the customers, supply, price, quality of the products, etc., hence making decisions after studying the pattern of events say forecasting sales, expenses, advertising for the products, financial resources, location of the business, to mention but a few.
- Statistics plays a central role in banking. The banks use statistics in various ways. The banks apply the principle that all the people, companies, organizations or institutions who deposit their money do not withdraw it at the same time. They use statistical methods based on probability to estimate the number of depositors, how much can be loaned and withdrawn on a certain day.
- Statistics plays an important role in accounting. Accounting is impossible without exactness. Accountants use statistics to provide information to shareholders and other business stakeholders regarding business liability.
- Statistics is essential in auditing. Auditing uses the sampling techniques to determine whether books of accounts have been prepared and trace sources of errors.
- Statistics is useful in medicine. Medicine deals with treatments that work often but not always, so treatment success entirely depends on probability. Doctors keep clinical records on a daily basis and, hence, refer to them when a related case reoccurs. In case of an epidemic, appropriate statistical comparisons and clarity of exposition are made

**QUESTION FIVE**

**Marking guide:**

| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **a** | Decision making environments: | | |
| | Correct statement of the environment (1*3) | 3 | |
| | Correct explanation of environment (1*3) | 3 | 6 |
| **b** | Advantages of decision trees: | | |
| | Each correct advantage stated (1*2) | | 2 |
| **c** | Drawing the decision tree: | | |
| | Each correct event drawn and labeled (0.5*9) | 4.5 | |
| | Each correct decision alternative drawn and labeled (0.5*3) | 1.5 | |
| | Formula | 1.0 | |
| | Computation of each EMV (1*3) | 3.0 | |
| | Decision for expected monetary value | 1.0 | |
| | Reason for the decision of expected monetary value | 1.0 | 12 |
| | **Total Marks** | | **20** |

**Model Answers**

a) Decision making environments

**1. Decision-Making under Certainty**

In this case, the decision-maker knows with certainty the consequences of every alternative or decision choice. The decision-maker presumes that only one state of nature is relevant for his purpose. He identifies this state of nature, takes it for granted and presumes complete knowledge as to its occurrence.

**2. Decision-Making Uncertainty**

When the decision-maker faces multiple states of nature but he has no means to arrive at probability values to the likelihood of occurrence of these states of nature, the problem is a decision problem under uncertainty. Such situations arise when a new product is introduced in the market or a new plant is set up. In business, there are many problems of this 'nature'. Here, the choice of decision largely depends on the personality of the decision-maker. The following choices are available before the decision-maker in situations of uncertainty.

(a) Maximax Criterion
(b) Minimax Criterion
(c) Maximin Criterion
(d) Laplace Criterion (Criterion of equally likelihood)
(e) Hurwitz Alpha Criterion (Criterion of Realism)

**3. Decision-Making under Risk**

In this situation, the decision-maker has to face several states of nature. But he has some knowledge or experience which will enable him to assign probability to the occurrence of each state of nature. The objective is to optimize the expected profit, or to minimize the opportunity loss.

For decision problems under risk, the most popular methods used are Expected Monetary Value (EMV) criterion, Expected Opportunity Loss (EOL) criterion or Expected Value of Perfect Information (EVPI).

b) Advantages of decision trees

i) They are simple to understand and interpret. Decision trees are generally quite intuitive to understand and easy to interpret.

ii) The layout of events makes alternative courses of action clearer.

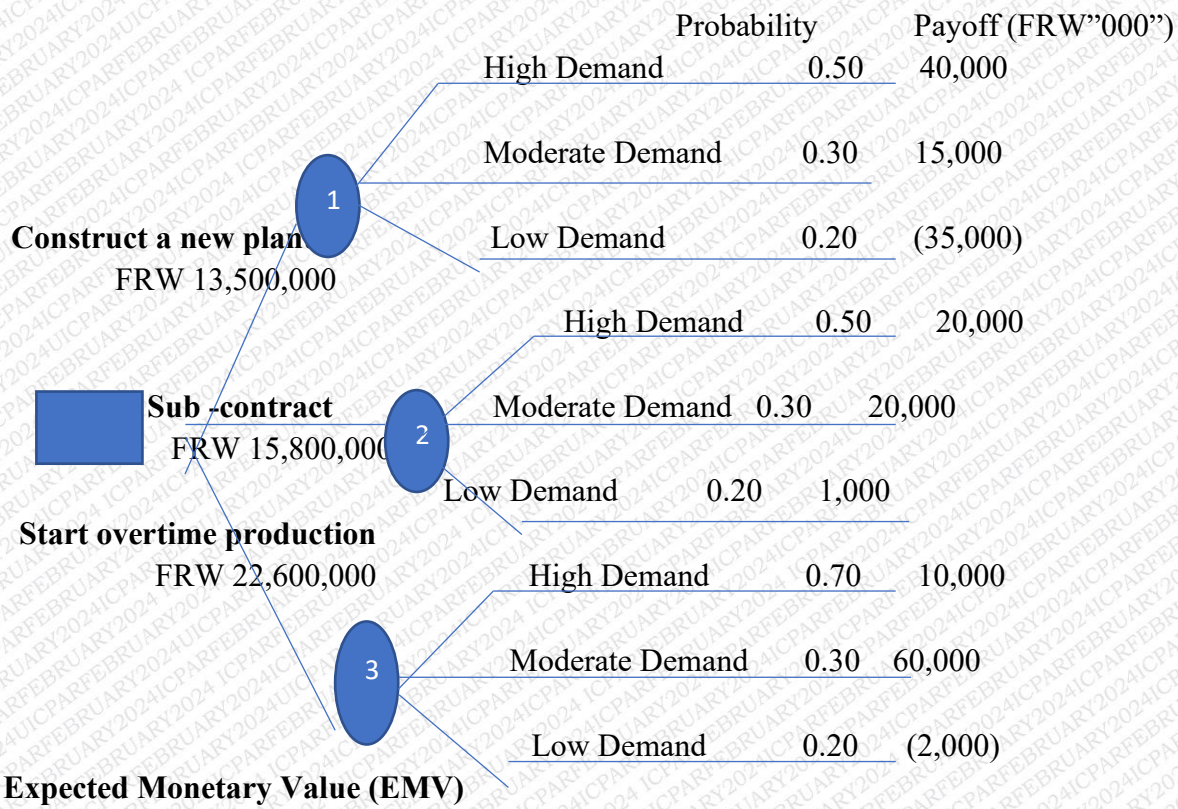
iii) They do not require normalization of data

iv) They do not require scaling of data as well

v) Compared to other algorithms, decision trees require less effort for data preparation during pre – processing

c) Decision tree

**Decision Tree**




**Expected Monetary Value (EMV)**

**Construct a new plant:**

EMV = (0.5*FRW 40,000,000) + (0.3*FRW 15,000,000) +(0.2*FRW -35,000,000)

EMV = FRW 16,000,000 + FRW 4,500,000 – 7,000,000 = **FRW 13,500,000**.

**Sub contraction:**

EMV = (0.5*FRW 20,000,000) + (0.3*FRW 20,000,000) +(0.2*FRW 1,000,000)
EMV = FRW 10,000,000 + FRW 6,000,000 – 200,000 = **FRW 15,800,000**.

**Starting overtime production**:
EMV = (0.5*FRW 10,000,000) + (0.3*FRW 60,000,000) +(0.2*FRW -2,000,000)
EMV = FRW 5,000,000 + FRW 18,000,000 – 400,000 = **FRW 22,600,000**.

**Advice**
The right decision is to start an **overtime production** because it has the highest expected monetary value of **FRW 22,600,000**

**QUESTION SIX**

**Marking guide:**

| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **a** | Computation of Break – even units and sales value: | | |
| | Formula for contribution per unit | 1 | |
| | Computation of contribution per unit | 1 | |
| | Formula for break – even units | 1 | |
| | Computation of break – even units | 1 | |
| | Formula for break – even sales value | 1 | |
| | Computation of break – even sales value | 1 | 6 |
| **b** | Definition of margin of safety: | | |
| | Correct definition | | 1 |
| **c** | Calculation of margin of safety in units and %: | | |
| | Formula for margin of safety in units | 1 | |
| | Calculation of margin of safety in units | 1 | |
| | Formula for margin of safety in % | 1 | |
| | Calculation of margin of safety in % | 1 | 4 |
| **d** | Calculation of sales units with target profit | | |
| | Formula | 1 | |
| | Calculation of sales units | 2 | 3 |
| **e** | Calculation of sales units with target profit and changes in costs: | | |
| | Calculation of increase in direct material cost per unit | 1 | |
| | Calculation of increase in direct labour cost per unit | 1 | |
| | Calculation of sales units required to achieve the desired profit | 2 | 4 |
| **f** | Limitations of break – even analysis (1*2) | | 2 |
| | **Total Marks** | | **20** |

**Model Answers**

a) Break – even in units and break – even in sales

Contribution per unit = selling price per unit – variable cost per unit (Variable cost + direct material+ direct labour)

Contribution per unit = FRW 320/unit – FRW (84 + 80 + 36)/ unit

Contribution per unit = FRW320/unit – FRW 200/unit = **FRW 120/unit**

$$\text{Break – even (in units)} = \frac{\text{Fixed overhead}}{\text{contribution per unit}}$$

$$\text{Break – even (in units)} = \frac{4{,}000 \text{ units} * \text{FRW24 per unit}}{\text{FRW120per unit}} = \frac{\text{FRW } 96{,}000}{\text{FRW120per unit}} = \mathbf{800 \text{ units}}$$

Break – even in sales value = Break – even units * selling price per unit

Break – even in sales value = 800 unit * FRW 320 per unit = **FRW 256,000**

b) Margin of safety

The margin of safety is defined as the excess of normal or actual sales over sales at break- even point. It may be expressed in terms of sales volume or sales revenue.

Margin of safety is how much output or sales level can fall before a business reaches its break-even point.

c) Margin of safety in units = Budgeted sales units – Break - even units

Margin of safety = 4,400 units – 800 units = **3,600 units**

$$\text{Margin of safety in \%} = \frac{\text{Budgeted sales units} - \text{Break} - \text{even units}}{\text{Budgeted sales units}} * 100$$

$$\text{Margin of safety in \%} = \frac{4{,}400 - 800}{4{,}400} * 100 = \frac{3{,}600}{4{,}400} * 100 = \mathbf{81.82\ \%}$$

d) Calculation of sales units required to achieve a target profit of FRW 564,000

$$\text{Sales units} = \frac{\text{Fixed overhead} + \text{Target profit}}{\text{contribution per unit}}$$

$$\text{Sales units} = \frac{96{,}000 + \text{FRW } 564{,}000}{120}$$

$$\text{Sales units} = \frac{\text{FRW } 660{,}000}{120} = \text{FRW } \mathbf{5{,}500 \text{ units}}$$

e) Sales units if direct material cost per unit increases by 6% and direct labour cost per unit increases by 5% and a desired profit is FRW 480,000.

Increase in the direct material cost per unit = FRW 84 + (6% * FRW 84) = **FRW 89.04/unit**

Increase in the direct labour cost per unit = FRW 80 + (5% * FRW 80) = **FRW 84.00/unit**

$$\text{Sales units} = \frac{\text{FRW } 96{,}000 + \text{FRW } 480{,}000}{(320 - (89.04 + 84.00 + 36.00)} = \frac{\text{FRW } 96{,}000 + \text{FRW } 480{,}000}{(320 - (89.04 + 84.00 + 36.00)}$$

$$\text{Sales units} = \frac{\text{FRW } 576{,}000}{209.04} = \text{FRW } \mathbf{2{,}755 \text{ units}}$$

f) Assumptions of break – even analysis

1. Breakeven analysis assumes that the selling price of the product never changes. This is not correct. If a customer placed a very large order, he would expect a quantity discount on the normal selling price.

2. Most businesses sell more than one product, so break-even for the business becomes a lot more complicated to work out.

3. Breakeven assumes that sales and output (the number of products the business makes) are the same – i.e. – the business sells everything that it makes. This is unrealistic. It does not take into account the build-up of stocks.

4. Variable costs do not always stay the same. For example, as output rises, the business may benefit from being able to buy ingredients at lower prices (quantity discount), which would reduce the variable cost per unit.

**QUESTION SEVEN**

**The Rights of Employees Agency (REA):**

**Marking guide:**

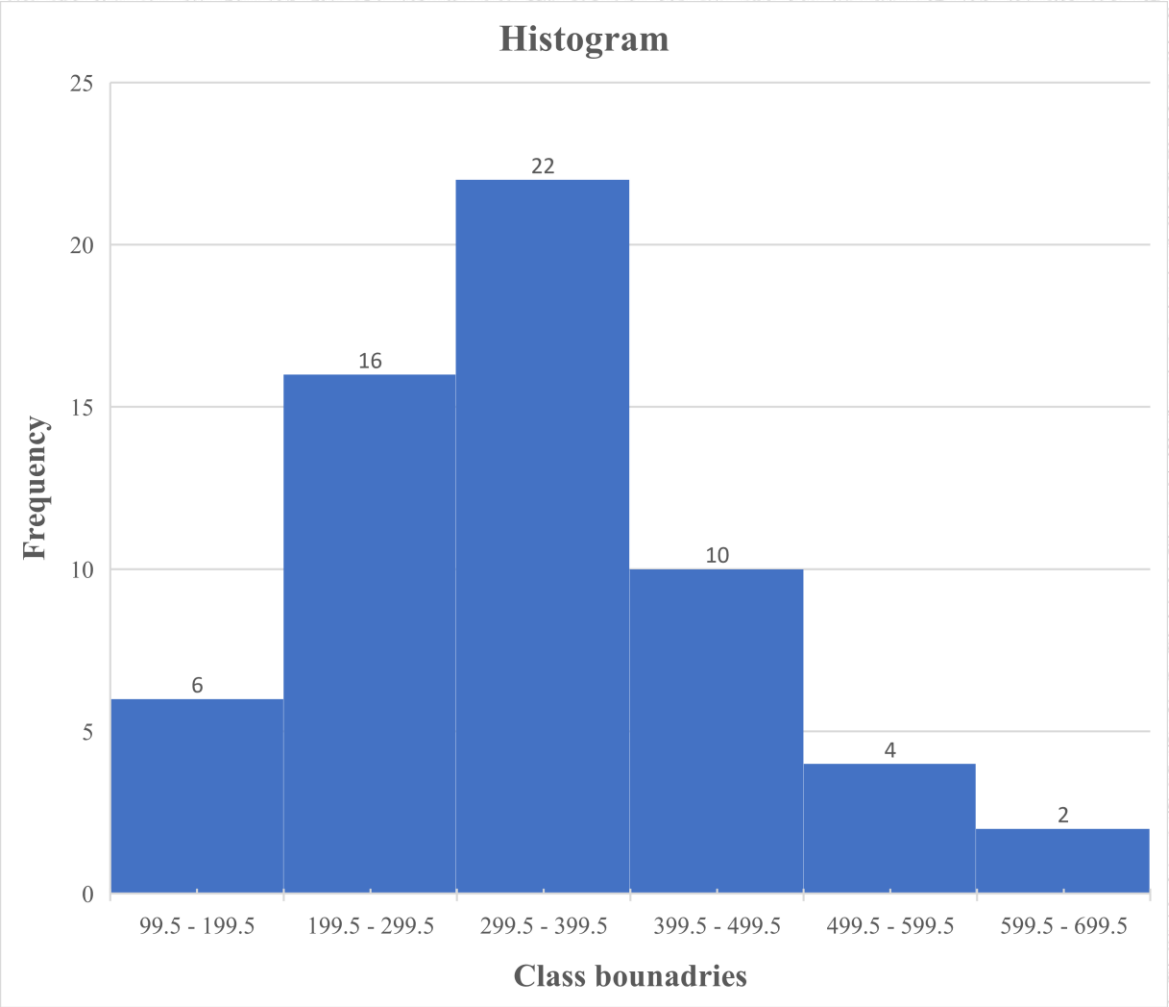
| Qn | Description | Marks | Total Marks |
|---|---|---|---|
| **(i)** | Presentation of data in a frequency table: | | |
| | Correct tabulation of classes (0.5*6) | 3 | |
| | Correct tabulation of frequencies (0.5*6) | 3 | |
| | Correct tabulation of class boundaries (0.5*6) | 3 | 9 |
| **(ii)** | Drawing the Histogram: | | |
| | Each correct bar drawn and labeled (1*6) | 6 | |
| | Correct naming of the vertical axis | 1 | |
| | Correct naming of the horizontal axis | 1 | |
| | Title of the graph | 1 | 9 |
| **(iii)** | Frequency polygon: | | |
| | Definition of a frequency polygon | 1 | |
| | Circumstance when a frequency polygon can used in place of a histogram | 1 | 2 |
| | **Total Marks** | | **20** |

**Model Answers**

i) Presentation of data using a histogram

| Class (FRW"000") | Frequency (F) | Class Boundaries |
|---|---|---|
| 100 – 199 | 6 | 99.5 - 199.5 |
| 200 - 299 | 16 | 199.5 - 299.5 |
| 300 - 399 | 22 | 299.5 - 399.5 |
| 400 – 499 | 10 | 399.5 - 499.5 |
| 500 - 599 | 4 | 499.5 - 599.5 |
| 600 – 699 | 2 | 599.5 - 699.5 |
| | **60** | |

ii) Histogram




iii) Definition of a frequency polygon

A frequency polygon is the graph joining of the mid-points of the tops of the adjoining bars. The mid-points of the first and the last classes are joined to the mid-points of the classes preceding the first and succeeding the last respectively at zero frequency to complete the polygon.

Circumstance where a frequency polygon is used in place of a histogram;

Frequency polygons can always be used in place of histogram, but are particularly useful:

- When there are many classes in the distribution; or
- If two or more frequency distributions need to be compared

**END OF MARKING GUIDE AND MODEL ANSWERS**