UNIVERSITI MALAYSIA TERENGGANU

FINAL EXAMINATION

SEMESTER I SESSION 2025/2026 (BACHELOR DEGREE)

COURSE	:	**QUANTITATIVE METHODS IN DECISION MAKING**
COURSE CODE	:	**MGM3063**
DURATION	:	**2 HOURS**

MATRIC NO.	:	_____
PROGRAMME	:	_____
SEAT NO.	:	_____

INSTRUCTIONS TO CANDIDATES

i. Answer all questions.

ii. All answers must be written in answer booklet provided.

DO NOT OPEN THE QUESTION PAPER UNTIL INSTRUCTED

THIS QUESTION PAPER CONSISTS OF FIVE (5) PRINTED PAGES

Please answer all questions. (100 Marks)

1. Amir manages a small electronics store that sells wireless earbuds. The annual demand for a specific model is 12,000 units. The cost of placing an order is RM20, while the annual holding cost is 15% of the unit cost. The supplier offers the following pricing schedule:

   - Unit price = RM30.00 for orders below 1,000 units
   - Unit price = RM29.50 for orders 1,000 units or more

   a. Explain **two (2)** factors that influence a company's decision to accept a quantity discount. (4 Marks)

   b. Analyse the minimum total annual cost (including purchase, ordering, and holding costs) by determining the **most** economical order quantity. (11 Marks)

   c. Evaluate the reorder point if the lead-time demand is normally distributed with a mean of 800 units and a standard deviation of 120 units, and Amir wants to maintain a 97.5% service level (5 Marks)

2. Amelia Construction Ltd. has been contracted to build a small eco-friendly community park. The company wants to estimate the expected duration, variance, and probability of meeting the project. The following table summarizes the estimated completion times (in days) and activity dependencies:

Activity	Optimistic Time	Most Likely Time	Pessimistic Time	Immediate Predecessor(s)
A	2	4	6	--
B	4	6	8	--
C	2	3	4	A
D	3	4	5	A
E	4	5	6	B
F	3	5	7	C, D
G	2	4	6	D, E
H	3	4	5	F, G

   a. Evaluate the expected duration of the project using a PERT network diagram. (12 Marks)

   b. If the project must be completed in 20 days, analyse the probability of finishing the project on time. (8 Marks)

3. FreshBake Ltd produces two types of baked products, Bread Loaves (Product A) and Cakes (Product B). The production process uses two main resources: Oven Time and Labor Hours. Production data and profits are shown below:

Product	**Oven Time (hours/unit)**	**Labor Hours (hours/unit)**	**Profit per unit (RM)**
A (Bread Loaves)	2	1	30
B (Cakes)	1	3	45

Each day, the bakery has 120 hours of oven time and 150 labor hours available. Management wants to determine the production quantities that will maximize total profit while maintaining consistent product quality.

a. Develop a Linear Programming model to determine the optimal number of Bread Loaves and Cakes to produce each day in order to maximize total profit, subject to the resource constraints. (10 Marks)

b. During production, quality inspectors check 30 baked items every hour for signs of underbaking. Records show an average of 3 defective items per sample. Analyse the inspection data to create a 99.7% c-chart and interpret the results. (10 Marks)

4. Sunik operates a warung nasi lemak with varying service configurations. He is considering two options:

2 novice workers (service rate: 70 packs/hour)
1 expert worker (service rate: 65 packs/hour)

Demand rate is 50 packs /hour. The cost of customer waiting time is RM1.5/hour, the salary for a novice worker is RM35/day, and the expert is at RM50/day.

You need to advise Madam Sunik to decide on the problem by comparing and analyzing the operating characteristics for each configuration:

a. average time in system (4 Marks)
b. queue length (4 Marks)
c. waiting time (4 Marks)
d. the percent idle time (4 Marks)
e. the total daily cost (waiting cost + service cost) for each option and determine which configuration offers the most cost-effective solution. (4 Marks)

5. Lina operates a laptop repair shop and wants to improve her inventory management for replacement screens. She decides to use a Monte Carlo simulation to model daily demand for screens over a 10-day period. Historical data shows the following daily demand distribution:

Daily Demand	Frequency (Days)	Probability
0	5	0.05
1	15	0.15
2	30	0.30
3	25	0.25
4	15	0.15
5	10	0.10

Lina uses a random number table to simulate demand. The random numbers for 10 days are:

12	47	89	03	55	28	76	34	61	99

Required:

a. Explain the steps involved in conducting a Monte Carlo simulation for inventory demand. (5 Marks)

b. Construct the cumulative probability distribution and assign random number intervals for each demand level. (5 Marks)

c. Simulate the daily demand for 10 days using the random numbers provided and calculate total demand and average daily demand. (5 Marks)

d. Compare the simulated average daily demand with the expected daily demand, and draw your conclusion. (5 Marks)

End of Question Paper

Formula

Criterion of realism (Hurwicz): Weighted average = α(best in row) + (1−α)(worst in row)
EMV (alternative i) = (payoff of first state of nature)×(probability of first state of nature)+ (payoff of second state of nature)×(probability of second state of nature)+ … + (payoff of last state of nature)×(probability of last state of nature)
$Q^* = \sqrt{\frac{2DC_o}{IC}}$ ROP = (Demand per day) × (Lead time for a new order in days) $= d \times L$
C_h = IC
Total cost $= DC + \frac{D}{Q}C_o + \frac{Q}{2}C_h$
$t = \frac{a + 4m + b}{6}$ Variance = $\left(\frac{b-a}{6}\right)^2$
Slack = LS − ES, or Slack = LF − EF
Project variance = ∑variances of activities on the critical path
λ = mean number of arrivals per time period
μ = mean number of customers or units served per time period
$L = \frac{\lambda}{\mu - \lambda}$ $W = \frac{1}{\mu - \lambda}$ $L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}$ $W_q = \frac{\lambda}{\mu(\mu - \lambda)}$
$P_0 = 1 - \frac{\lambda}{\mu}$ $\rho = \frac{\lambda}{\mu}$
Expected daily demand $= \sum_{i=0}^{5}$(Probability of i tires)(Demand of i tires)
$\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}}$ Upper control limit (UCL) $= \bar{\bar{x}} + z\sigma_{\bar{x}}$ Lower control limit (LCL) $= \bar{\bar{x}} - z\sigma_{\bar{x}}$
$UCL_R = D_4\bar{R}$ $UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R}$ $LCL_R = D_3\bar{R}$ $LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R}$
$UCL_p = \bar{p} + z\sigma_p$ $LCL_p = \bar{p} - z\sigma_p$ $\hat{\sigma}_p = \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
$\bar{p}$ = mean proportion or fraction defective in the sample
z = number of standard deviations
σ_p = standard deviation of the sampling distribution σ_p is estimated by $\hat{\sigma}_p$
$\bar{c} \pm 3\sqrt{\bar{c}}$