# PEPERIKSAAN AKHIR
**SEMESTER KEDUA SESI 2002 / 2003**

<table>
<thead>
<tr>
<th>KOD/NAMA KURSUS</th>
<th>QP2013 SAINS PEMUTUSAN II</th>
</tr>
</thead>
<tbody>
<tr>
<td>TARIKH</td>
<td>9 MAC 2003</td>
</tr>
<tr>
<td>MASA</td>
<td>2:30 PTG.– 5:00 PTG. (2 JAM)</td>
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<td>TEMPAT</td>
<td>DKG 4(3)</td>
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**ARAHAN:**

1. Kertas soalan ini mengandungi **DUA BELAS** (12) soalan dalam **SEPULUH** (10) halaman bercetak.
2. Anda dikehendaki menjawab **SEMUA** soalan di dalam ruang yang disediakan.
3. Anda dibenarkan untuk menjawab sama ada di dalam Bahasa Melayu atau Bahasa Inggeris.
4. Satu senarai rumusan dan jadual ada dilampirkan untuk rujukan anda.

**NO. MATRIK :**

( dengan perkataan )

( dengan angka )

**NO. KAD PENGENALAN :**

**NAMA PENSYARAH :** DR. ENKU MUHAMMAD NAZRI BIN ENKU ABU BAKAR

**KUMPULAN :** A

**NOMBOR MEJA :**

JANGAN BUKA KERTAS SOALAN INI
SEHINGGA DIBERI ARAHAN

*SULIT*
QUESTION 1 (12 POINTS)

a) List the three types of integer programming models. (3 points)
   i.
   ii.
   iii.

b) In queuing analysis, describe two ways to improve the service rate of a system. (2 points)
   i.
   ii.

c) Discuss two limitations of the graphical method for solving goal programming problems. (2 points)
   i.
   ii.

d) Indicate two ways how the results of a simulation model can be validated. (2 points)
   i.
   ii.

e) Indicate three assumptions encompassed by the classical EOQ inventory model. (3 points)
   i.
   ii.
   iii.
QUESTION 2 (4 POINTS)

Consider a capital budgeting example with 5 projects from which to select. Let \( x_a = 1 \) if project \( a \) is selected, 0 if not, for \( a = 1, 2, 3, 4, 5 \). Write the appropriate constraint(s) for each of the conditions below:

a) If project 1 is chosen, project 5 must not be chosen. (1 point)

b) Projects cost $100, $200, $150, $75, and $300 respectively. The total budget is $450. (1 point)

c) No more than 2 of projects 1, 2, and 3 can be chosen. (1 point)

d) If project 2 is chosen, project 3 must also be chosen. (1 point)

QUESTION 3 (5 POINTS)

Suppose we have the following integer programming problem.

\[
\text{Maximize } Z = 2x_1 + x_2 \\
\text{Subject to} \\
5x_1 + 2x_2 \leq 8 \\
x_1 + x_2 \leq 3 \\
x_1, x_2 \geq 0 \text{ and } x_1 \text{ integer}
\]

Suppose that the optimum solution for the relaxed model is \( x_1 = 2/3, x_2 = 7/3, Z = 11/3 \). Show one step of the branch and bound process that is needed to solve the original problem.
QUESTION 4 (10 POINTS)

If a monopolist produces q units of item A, she can charge $(100 - 4q) per unit. The fixed cost of production is $50 and the variable cost is $2 per unit.

a) How can the monopolist maximize profits? (6 points)

b) If a sales tax of $2 per unit must be paid by the monopolist, would she increase or decrease production? (4 points)
QUESTION 5 (9 POINTS)

A company is planning to spend $10,000 on advertising. It costs $3000 per minute to advertise on television and $1000 per minute to advertise on radio. If the firm buys x minutes of television advertising and y minutes of radio advertising, its revenue in thousands of dollars is given by \( f(x,y) = -2x^2 - y^2 + xy + 8x + 3y \).

a) How can the firm maximize its revenue? (Use Lagrange multiplier to solve this problem). (7 points)

b) Show that if M dollars are available for advertising, an extra dollar spent on advertising will increase revenue by approximately \((11 - M)/4\). (2 points)
QUESTION 6 (7 POINTS)

Highland Appliance must determine how many colour TVs and VCRs should be stocked. It costs Highland $300 to purchase a colour TV and $200 to purchase a VCR. A colour TV requires 3 sq yd of storage space, and a VCR requires 1 sq yd of storage space. The sale of a colour TV earns Highland a profit of $150, and the sale of a VCR earns Highland a profit of $100. Highland has set the following goals (listed in order of importance):

Goal 1: A maximum of $20,000 can be spent on purchasing colour TV’s and VCRs.
Goal 2: Highland should earn at least $11,000 in profits from the sale of colour TVs and VCRs.
Goal 3: Colour TVs and VCRs should not use up more than 200 sq yd of storage space.
Formulate a goal programming model that Highland could use to determine how many colour TVs and VCRs to order.
QUESTION 8 (9 POINTS)

Given the following model

Minimize $P_1d_2^-, P_2d_1^+, P_3d_3^-$
Subject to

\begin{align*}
6x + 10y + d_1^- - d_1^+ &= 90 \\
2x + y + d_2^- - d_2^+ &= 24 \\
y + d_3^- - d_3^+ &= 8 \\
x, y, d_1^-, d_3^+ &\geq 0
\end{align*}

a) Solve the model graphically and indicate whether each goal is achieved or not. (7 points)

b) What is the optimal value for $x$ and $y$ in (a)? (2 points)
QUESTION 9 (12 POINTS)

In a waiting line situation, arrivals occur around the clock at a rate of six per day, and the service occurs at one every three hours. Assume the Poisson and exponential distributions for arrival rate and service rate respectively.

a) What is $\lambda$ and $\mu$? (2 points)

b) Find the probability that 1 customer is being serviced and 1 customer is waiting. (2 points)

c) Find the average number of units in the system. (2 points)

d) Find average time in the waiting line. (2 points)

e) Find probability that an arrival will not have to wait to get serviced. (2 points)

f) Find probability that an arrival will have to wait before being serviced? (2 points)
QUESTION 10 (11 POINTS)

Estimates of the financial information for a new product show the following information:

<table>
<thead>
<tr>
<th>Units sold</th>
<th>Probability</th>
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<tbody>
<tr>
<td>600</td>
<td>0.25</td>
</tr>
<tr>
<td>800</td>
<td>0.25</td>
</tr>
<tr>
<td>1000</td>
<td>0.50</td>
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</table>

Fixed cost is $10,000, variable cost is $5/unit and revenue is $20/unit.

a) Calculate the total profit for each case of the units sold above. (4 points)

<table>
<thead>
<tr>
<th>Units sold</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>------</td>
</tr>
<tr>
<td>800</td>
<td>------</td>
</tr>
<tr>
<td>1000</td>
<td>------</td>
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b) Simulate the model to find the estimation for net profit using the following set of 10 random numbers. (7 points)

87, 55, 03, 50, 33, 92, 08, 15, 45, 47
QUESTION 11 (10 POINTS)

A company buys calculators at a price of $5 per unit. The holding cost of each calculator is $0.75. The demand for the calculator is 20,000. The cost of ordering is $25.00.

a) What is the economic order quantity? (4 points)

b) What is the cycle time? (3 points)

c) What is the annual ordering cost? (3 points)
QUESTION 12 (11 POINTS)

At the Old Mill Park adjacent to the Blue Ridge Parkway in Virginia, stone ground corn meal is produced at the old mill. The mill can produce 600 pounds of corn meal per day, and the demand for corn meal is 360 pound per day. The park and mill are open 365 days per year. The cost of setting up the mill and producing a batch of corn meal is $15 while the cost of carrying a pound of meal in storage is $0.35 per pound.

Compute:

a) The optimal amount of corn meal that should be produced each time the mill is run. (5 points)

b) The minimum total annual inventory cost. (3 points)

c) The number of times the mill is run per year. (3 points)
SENARAI RUMUS

UJIAN KONSISTENSI UNTUK PROSES ANALISIS HIRAKI

\[ CI = \frac{\sum_{i=1}^{n} d_i^2}{n} \]

di mana \( n \) = bilangan item yang dibandingkan

\( * \) = (kena tahu sendiri)

<table>
<thead>
<tr>
<th>n</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI</td>
<td>0</td>
<td>0.58</td>
<td>0.90</td>
<td>1.12</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.45</td>
<td>1.51</td>
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Perbandingan adalah konsisten sekiranya \( CI/RI < 0.10 \)

SISTEM INVENTORI

MODEL STATIK (SAIZ LOT EKONOMI) atau EOQ

\[ Q_{\text{opt}} = \sqrt{\frac{2CD}{C_s}} \]

Jumlah kos penangguhan per unit masa = \( C_c \frac{Q}{T} \)

Jumlah kos penyediaan per unit masa = \( C_o \frac{D}{Q} \)

Bilangan pesanan per unit masa = \( \frac{D}{Q_{\text{opt}}} \)

MODEL SAIZ LOT EKONOMI DENGAN PENGISIAN SEMULA SECARA SERAGAM

\[ Q_{\text{opt}} = \sqrt{\frac{2CD}{C_s(1 - \frac{d}{p})}} \]

Jumlah kos penangguhan per unit masa = \( C_c \frac{Q}{T} (1 - \frac{d}{p}) \)

Jumlah kos penyediaan per unit masa = \( C_o \frac{D}{Q} \)

Bilangan pesanan per unit masa = \( \frac{D}{Q_{\text{opt}}} \)
SISTEM GILIRAN SATU PELAYAN

Kebarangkalian tiada pelanggan dalam sistem $= P_0 = (1 - \frac{\lambda}{\mu})$

Kebarangkalian terdapat n pelanggan dalam sistem $= P_n = (\frac{\lambda}{\mu})^n (1 - \frac{\lambda}{\mu})$

Purata bilangan pelanggan dalam sistem $= L = \frac{\lambda}{\mu - \lambda}$

Purata bilangan pelanggan menunggu dalam baris menunggu $= L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}$

Purata masa setiap pelanggan berada dalam sistem $= W = \frac{1}{\mu - \lambda}$

Purata masa setiap pelanggan menunggu dalam baris menunggu $= W'_q = \frac{\lambda}{\mu(\mu - \lambda)}$

Kebarangkalian pelayan bertugas (digunakan) $= U = \frac{\lambda}{\mu}$

Di mana $\lambda$ = kadar ketibaan (purata bilangan ketibaan pelanggan per unit masa)
$\mu$ = kadar layanan (purata bilangan pelanggan yang dilayani per unit masa)