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

**KOD/NAMA KURSUS** : QS 2113 BAYESIAN DECISION THEORY  
**TARIKH** : 30 SEPTEMBER 2002 (ISNIN)  
**MASA** : 2.30 – 5.00 PETANG (2 ½ JAM)  
**TEMPAT** : DP 1/2

### ARAHAN :

1. Kertas soalan ini mengandungi LIMA (5) soalan dalam DUA (2) halaman bercetak.
2. Anda dikehendaki menjawab SEMUA soalan di dalam kertas jawapan yang disediakan.

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<th>NO. MATRIK :</th>
<th>[ ] [ ] [ ] [ ] [ ]</th>
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<td>(dengan perkataan)</td>
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| NO. KAD PENGENALAN : | [ ] [ ] [ ] [ ] [ ] [ ] [ ] |

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<tr>
<th>NAMA PENSYARAH :</th>
<th>ABDULL HALIM ABDUL</th>
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<td>KUMPULAN :</td>
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**JANGAN BUKA SOALAN INI SEHINGGA DIBERI ARAHAN**

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*SULIT*
**QUESTION 1 (20 marks)**

Suppose that $\theta$ represents the rate of return (expressed in decimal form, not in percentage form) for a particular investment and that your uncertainty about $\theta$ can be expressed in terms of the following probability distribution:

$$f(\theta) = \begin{cases} \frac{100(\theta - 0.10)}{3} & \text{if } -0.10 \leq \theta \leq 0.10 \\ \frac{200(0.20 - \theta)}{3} & \text{if } 0.10 \leq \theta \leq 0.20 \\ 0 & \text{elsewhere} \end{cases}$$

i. Graph this prior distribution and discuss what it implies about your judgements concerning $\theta$.

ii. If it is decided that the likelihood function is

$$f(y \mid \theta) = 5 \quad \text{if} \quad -0.10 \leq \theta \leq 0.20$$

what is the posterior distribution of $\theta$?

**QUESTION 2 (20 marks)**

The number of customers entering a certain store on a given day is assumed to be normally distributed with unknown mean $\mu$ and unknown variance $\sigma^2$. As a store manager, you feel that your prior distribution for $\mu$ is a normal distribution with mean 1000 and variance 400. You then take a random sample of 10 days, observing a sample mean of $\bar{m} = 950$ customers and a sample variance of $s^2 = 3000$. Find your posterior distribution for $\mu$. (use a discrete approximation to the prior distribution with intervals of width 30).

**QUESTION 3 (20 marks)**

A decision maker owns drilling rights at a particular location and that he must decide how best to take advantage of these rights. To begin he must determine $A$, the set of actions available to him. After giving this matter some thought, he arrives at five potential actions:

- a) drilling with 100% interest;
- b) finding partner and drilling with 50% interest;
- c) “farming out” the drilling rights for a 0.125 override;
- d) “farming out” the drilling rights for $50,000 and 0.06 override and
- e) not drilling.

Based on his knowledge on the geological structure of the site he decides to consider only five possible states of nature, $\theta$:

- a) 0 (dry hole)
- b) 75,000 barrels
- c) 150,000 barrels
d) 600,000 barrels
e) 1,300,000 barrels

From past experience he is willing to consider the prior distribution of $\theta$ as follows:

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>$P(\theta)$</th>
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<tbody>
<tr>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td>75,000</td>
<td>0.10</td>
</tr>
<tr>
<td>150,000</td>
<td>0.15</td>
</tr>
<tr>
<td>600,000</td>
<td>0.10</td>
</tr>
<tr>
<td>1,300,000</td>
<td>0.05</td>
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</tbody>
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The cost of drilling is $100,000 and the net profit from oil recovered will be approximately $1.00 per barrel.

Construct the loss table and decide which action will be chosen according to:

i. minimax regret criterion
ii. EL criterion

Another possibility available to him is to purchase seismic information concerning the site. This information which costs $25,000 is used to indicate the presence of oil; whether it is dry, rich or average. Should he purchase the information? Why?

**QUESTION 4 (20 marks)**

UUM is trying to implement a policy, “one doctor for every student attending to the clinic for every 30 minutes”. In a recent research it is found out that the attendance to the clinic is distributed Poisson with mean 2.0 for every 30 minutes. Estimate the number of doctor needed if the loss due to over estimate is double of the loss due to under estimate.

**QUESTION 5 (20 marks)**

Suppose that a marketing manager is interested in $p$, the proportion of consumers that will buy a particular new product. He considers the following hypotheses:

$H_0: p = 0.10$ and $H_1: p = 0.20$

His prior probabilities are $P(H_0) = 0.85$ and $P(H_1) = 0.15$, and a random sample of 8 customers results in 3 who state that they will buy the product if it is marketed.

i. What is the prior odds ratio?
ii. What is the likelihood ratio
iii. The manager decides that the posterior probability of $H_0$ must be no larger than 0.40 to make it worthwhile to market the product. Should the product be marketed?