

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN MATEMATIK SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI 1:2015/2016

**BBM3033 : PROBABILITY AND STATISTICS FOR ENGINEERING
TECHNOLOGY**

TARIKH : 05 JANUARI 2016

MASA : 8.30 AM – 11.30 AM (3 JAM)

Kertas ini mengandungi **LIMA BELAS (15)** halaman bercetak.
Kertas ini mengandungi **EMPAT (4)** Soalan Struktur (**JAWAB SEMUA**).
Dokumen sokongan yang disertakan : Formula dan Table

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab semua soalan.

QUESTION 1

SOALAN 1

CLO1
C1

- a) The following data shows the age, in years, of buildings of 10 schools in Ipoh, Perak.

Data berikut menunjukkan usia, dalam tahun, 10 buah bangunan sekolah di Ipoh, Perak.

38 31 17 m 43 n 74 10 40 33

The mean age of the buildings is 37.3 years.

Min usia bagi bangunan-bangunan tersebut adalah 37.3 tahun.

- i) If the mode age of the buildings is 31 years, determine the values of m and n where $m < n$. [3 marks]

Jika mod usia bangunan tersebut ialah 31 tahun, tentukan nilai m dan n yang mana $m < n$. [3 markah]

- ii) Based on the values of m and n obtained in (i), find the median age of the buildings. [2 marks]

Berdasarkan nilai-nilai m dan n yang diperoleh dalam (i), cari nilai median usia bangunan-bangunan tersebut. [2 markah]

CLO1
C3

- b) Table 1 shows the number of books read by polytechnic students in one week.

Jadual 1 menunjukkan bilangan buku yang dibaca oleh pelajar politeknik dalam seminggu.

No. of books	1	2	3	4	5	6	7	8
No. of students	10	59	102	98	121	66	25	4

Table 1 / Jadual 1

Calculate the mean and standard deviation.

[5 marks]

Kirakan min dan sisihan piawai.

[5 markah]

- c) Table 2 shows the weight (in kg) of 71 students of a college.
Jadual 2 menunjukkan berat (dalam kg) 71 orang pelajar di sebuah kolej.

Weight (kg)	Number of students
39 – 44	5
45 – 50	2
51 – 56	21
57 – 62	12
63 – 68	21
69 – 74	7
75 – 80	3

Table 2 / *Jadual 2*

- i) Construct its frequency distribution table. Then, draw its histogram and frequency polygon. [7 marks]
Bina jadual taburan kekerapan. Seterusnya, bina histogram dan poligon kekerapan. [7 markah]
- ii) Based on the histogram, describe the type of mode of this set of data. Then, find the mode/modes from the histogram. [3 marks]
Berdasarkan histogram, huraikan jenis mod bagi set data ini. Seterusnya, cari mod/mod-mod daripada histogram. [3 markah]
- iii) By using a formula, calculate the mode/modes of the set of data. Then, by comparing both answers in (ii) and (iii), explain the accuracy of both answers. [5 marks]
Dengan menggunakan formula, kirakan nilai mod/mod-mod bagi set data tersebut. Seterusnya, dengan membandingkan kedua-dua jawapan di (ii) dan (iii), jelaskan kejituan kedua-dua jawapan. [5 markah]

QUESTION 2

SOALAN 2

a) A company decides to generate different identification number among their staff. If the identification number consists of five letters followed by two digits:
Sebuah syarikat memutuskan untuk menjana nombor pengenalan yang berbeza di kalangan kakitangan mereka. Jika nombor pengenalan mengandungi lima huruf dan diikuti dengan dua digit:

- i) How many identification numbers can be generated if repetitions are allowed? [3 marks]
Berapa banyak nombor pengenalan boleh dihasilkan jika ulangan dibenarkan? [3 markah]
- ii) How many identification numbers can be generated if repetitions are not allowed? [2 marks]
Berapa banyak nombor pengenalan boleh dihasilkan jika tidak boleh diulang? [2 markah]

b) In a statistics class there are 10 juniors and 18 seniors. 8 of the juniors are female, and 4 of the seniors are male. If a student is selected at random, find the probability of selecting the following:

Dalam suatu kelas Statistik terdapat 10 pelajar lama dan 18 pelajar baru. Terdapat 8 pelajar perempuan yang baru dan 4 pelajar lelaki yang lama. Jika pelajar tersebut dipilih secara rawak, cari kebarangkalian bagi pilihan yang berikut:

- i) A junior or a female. [5 marks]
Pelajar baru atau pelajar perempuan. [5 markah]
- ii) A senior or a female. [4 marks]
Pelajar lama atau pelajar perempuan. [4 markah]
- iii) A junior or a senior. [1 mark]
Pelajar baru atau pelajar lama. [1 markah]

CLO2
C4

- c) Table 3 shows the probability normal distributions of a random variable X.

Jadual 3 menunjukkan kebarangkalian taburan normal bagi pembolehubah secara rawak X.

X	2	3	4	5	6	7
$P(X = x)$	0.1	0.16	0.15	m	0.25	0.2

Table 3 / Jadual 3

- i) Calculate the value of m. [2 marks]
Kira nilai m. [2 markah]
- ii) Calculate the expected value and the variance of X. [4 marks]
Kira nilai jangkaan dan varians bagi X. [4 markah]
- iii) Find $P(3 \leq X \leq 7)$. [4 marks]
Cari $P(3 \leq X \leq 7)$. [4 markah]

QUESTION 3

SOALAN 3

CLO1
C2

- (a) A paint manufacturer wants to determine the average drying time of a new interior wall paint. If for 40 test areas of equal size he obtained a mean drying time of 66.3 minutes and a variance of 70.6 minutes:

Seorang pengeluar cat ingin menentukan purata masa pengeringan bagi cat dinding dalaman yang baru. Dalam 40 ujian tempat yang sama saiz dijalankan mendapati min bagi masa pengeringan adalah sebanyak 66.3 minit dan varian sebanyak 70.6 minit:

- i) Construct a 95% confidence interval for the true mean of the drying time, μ . [9 marks]
Bina 95% selang keyakinan bagi min sebenar bagi masa pengeringan, μ . [9 markah]
- ii) A worker says that the drying time of a new interior wall paint is 53 minutes. What conclusion can be made? [2 marks]
Seorang pekerja menyatakan bahawa masa pengeringan oleh cat dinding dalaman yang baru itu ialah 53 minit. Apakah kesimpulan yang boleh dibuat? [2 markah]
- iii) How large must a sample be selected if we want to be 90% confident of getting an interval that contains the true mean with a maximum error within 1 minute? [4 marks]
Berapakah sampel yang mesti dipilih jika kita mahu menjadikan 90% keyakinan bagi mendapatkan selang yang mengandungi min sebenar dengan kesalahan maksimum dalam lingkungan 1 minit? [4 markah]

CLO1
C3

- (b) In 12 test runs the gasoline consumption of an engine had a mean of x gallons and standard deviation of y gallons. The data is given.

Dalam 12 ujian yang dijalankan, penggunaan gasoline oleh sebuah enjin memperoleh min sebanyak x gelen dan sisihan piawai sebanyak y gelen. Berikut adalah data yang diberikan.

13.05	11.98	12.66	11.66	12.02	15.18
12.16	14.05	12.57	11.82	11.98	13.37

- i) Find the values of x and y . [5 marks]
Cari nilai x dan y . [5 markah]
- ii) Standard deviation is to measure the true variability of the gasoline consumption of the engine. Construct a 99% confidence interval for the standard deviation. [5 marks]
Sisihan piawai ialah mengukur kebolehubahan yang sebenar bagi penggunaan gasoline oleh enjin. Bina 99% selang keyakinan bagi sisihan piawai. [5 markah]

QUESTION 4

SOALAN 4

CLO1
C1

- a) Using the z table, find the critical values for $\alpha = 0.05$ (two tailed test) and $\alpha = 0.01$ (left tailed test), then draw a diagram to indicate both significance values. [5 marks]

Dengan menggunakan jadual z , cari nilai kritikal bagi $\alpha = 0.05$ (ujian dua-hujung) dan $\alpha = 0.01$ (ujian satu-hujung), kemudian lukis gambar rajah untuk menunjukkan bagi kedua-dua nilai keertian. [5markah]

CLO2
C3

- b) In a random sample of 100 tube lights produced by company A, the mean lifetime (mlt) of a tube light is 1190 hours with a standard deviation of 90 hours. Also in a random sample of 75 tube lights from company B the mean lifetime is 1230 hours with a standard deviation of 120 hours. Is there a difference between the mean lifetimes of the two brands of tube lights at a significance level of:

Dalam satu sampel rawak terdapat 100 tiub lampu yang dihasilkan oleh syarikat A, jika purata jangka hayat tiub adalah 1190 jam dengan sisihan piawai 90 jam. Jika terdapat satu lagi sampel rawak iaitu 75 tiub lampu dari syarikat B dimana purata jangka hayat tiub adalah 1230 jam dengan sisihan piawai 120 jam. Adakah terdapat perbezaan antara purata jangka hayat bagi dua jenama tiub lampu pada aras keertian berikut:

- i) 0.05 [7 marks]
[7 markah]
- ii) 0.01 [3 marks]
[3markah]

CLO2
C5

- c) A random sample of enrollments from an engineering school that specialize in mechanical and civil engineering is listed. A sample of 17 from mechanical department and 16 from civil department are randomly selected. At $\alpha = 0.05$, can it be concluded that there is difference in means. The statistics summary and output of the hypothesis test are given below:

Satu sampel rawak dipilih adalah pendaftaran dari sekolah kejuruteraan dimana sekolah tersebut pakar dalam mekanikal dan awam. Sampel kajian yang dipilih terdiri daripada 17 mekanikal dan 16 awam. Bolehkah kesimpulan dibuat apabila terdapat perbezaan bagi min. Gunakan $\alpha = 0.05$. Keputusan ringkasan statistik dan output ujian hipotesis adalah seperti di bawah:

	<i>mechanical</i>	<i>civil</i>
Mean	596.23529	481.5
Variance	26646.066	32182.8
Observations	17	16
Pooled Variance	29325.131	
Hypothesized Mean Difference	0	
df	31	
t Stat	1.9235547	
P(T<=t) one-tail	0.0318179	
t Critical one-tail	1.6955188	
P(T<=t) two-tail	0.0636358	
t Critical two-tail	2.0395134	

- i) State the null and alternative hypotheses. [2 marks]
Tentukan hipotesis nol dan hipotesis alternatif [2 markah]
- ii) Verify that the test statistic is 1.9235547 [3 marks]
Buktikan ujian statistik berikut 1.9235547 [3 markah]
- iii) Find the critical value and write your conclusion [5 marks]
Cari nilai kritikal dan berikan kesimpulan anda [5 markah]

SOALAN TAMAT

<p>Mean for a probability distribution, $\mu = \sum [X \cdot P(X)]$</p> <p>Variance and standard deviation for a probability distribution. $\sigma^2 = \sum [X^2 \cdot P(X)] - \mu^2$</p> $\sigma = \sqrt{\sum [X^2 \cdot P(X)] - \mu^2}$ <p>Expectation, $E(X) = \sum [X \cdot P(X)]$</p> <p>Binomial probability, $P(X) = \frac{n!}{(n-X)!X!} \cdot p^X \cdot q^{n-X}$</p> <p>Mean for binomial distribution, $\mu = np$</p> <p>Variance and standard deviation for the binomial distribution, $\sigma^2 = npq$ $\sigma = \sqrt{npq}$</p>	<p>Normal distribution</p> <p>Standard score, $z = \frac{X - \mu}{\sigma}$ or $\frac{X - \bar{X}}{s}$</p> <p>Mean of sample mean, $\mu_{\bar{X}} = \mu$</p> <p>Standard error of the means, $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$</p> <p>Central limit theorem formula, $z = \frac{X - \mu}{\sigma/\sqrt{n}}$</p>
---	---

SAMPLING AND ESTIMATION

<p>z confidence interval for means, $\bar{X} - z_{\alpha/2} \left(\frac{\sigma}{\sqrt{n}} \right) < \mu < \bar{X} + z_{\alpha/2} \left(\frac{\sigma}{\sqrt{n}} \right)$</p> <p>t confidence interval for means, $\bar{X} - t_{\alpha/2} \left(\frac{s}{\sqrt{n}} \right) < \mu < \bar{X} + t_{\alpha/2} \left(\frac{s}{\sqrt{n}} \right)$</p> <p>Sample size for means, $n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E} \right)^2$, where E is the maximum error of estimate.</p>	<p>Confidence interval for a proportion, $\hat{p} - (z_{\alpha/2}) \sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + (z_{\alpha/2}) \sqrt{\frac{\hat{p}\hat{q}}{n}}$</p> <p>Sample size for proportion, $n = \hat{p}\hat{q} \left(\frac{z_{\alpha/2}}{E} \right)^2$ where is the maximum error of estimate.</p> <p>Confidence interval for variance, $\frac{(n-1)s^2}{\chi_{right}^2} < \sigma^2 < \frac{(n-1)s^2}{\chi_{left}^2}$</p> <p>Confidence interval for standard deviation, $\sqrt{\frac{(n-1)s^2}{\chi_{right}^2}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi_{left}^2}}$</p>
--	---

FORMULA SHEET FOR PROBABILITY & STATISTICS FOR ENGINEERING TECHNOLOGY

DESCRIPTIVE STATISTICS	
Ungrouped Data	Grouped Data
Mean, $\bar{X} = \frac{\sum X}{n}$	Mean, $\bar{X} = \frac{\sum f \cdot X_m}{n}$
Population Variance, $\sigma^2 = \frac{\sum (X - \mu)^2}{N}$	Population Variance, $\sigma^2 = \frac{\sum f(X - \mu)^2}{N}$
Sample Variance, $s^2 = \frac{\sum (X - \bar{X})^2}{n-1}$	Sample Variance, $s^2 = \frac{\sum f(X - \bar{X})^2}{n-1}$
Or $s^2 = \frac{\sum X^2 - \left[\frac{(\sum X)^2}{n} \right]}{n-1}$	Or $s^2 = \frac{\sum fX_m^2 - \left[\frac{(\sum fX_m)^2}{n} \right]}{n-1}$
Population Standard Deviation, $\sigma = \sqrt{\sigma^2}$	
Sample Standard Deviation, $s = \sqrt{s^2}$	Median, $M = L_M + \left(\frac{\frac{N}{2} - F}{f_M} \right) C$
	Mode, $M_o = L_{M_o} + \left(\frac{d_1}{d_1 + d_2} \right) C$
PROBABILITY & STATISTICS	
Addition Rule (mutually exclusive events), $P(A \cup B) = P(A) + P(B)$	Conditional Probability, $P(B A) = \frac{P(A \cap B)}{P(A)}$
Addition Rule (events not mutually exclusive), $P(A \cup B) = P(A) + P(B) - P(A \cap B)$	Conditional Probability, $P(B A) = \frac{P(A \cap B)}{P(A)}$
Multiplication Rule (Independent event), $P(A \cap B) = P(A) \cdot P(B)$	Complementary events, $P(\bar{A}) = 1 - P(A)$
Multiplication Rule (dependent event), $P(A \cap B) = P(A) \cdot P(B A)$	Permutation Rule, ${}_n P_r = \frac{n!}{(n-r)!}$
	Combination Rule, ${}_n C_r = \frac{n!}{(n-r)!r!}$

HYPOTHESIS TESTING

Test for the population mean

z test, $z = \frac{X - \mu}{\sigma/\sqrt{n}}$, variance known

z test, $z = \frac{X - \mu}{s/\sqrt{n}}$, variance unknown

t test, $z = \frac{X - \mu}{s/\sqrt{n}}$, small sample

Test for two population mean

Test statistics, $z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$ for

variance is same.

Test statistics, $z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ for

variance not same.

Test statistics, $t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$ for small

samples.

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$