
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2009/2010 Academic Session

April/May 2010

MAA 161 – Statistics for Science Students
[Statistik untuk Pelajar Sains]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of EIGHT pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **all ten** [10] questions.

Arahan: Jawab **semua sepuluh** [10] soalan.]

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

1. The following data are the number of computer terminals produced at the SYAWALIS Corporation for a sample of 30 days

50	51	52	47	41	52	56	44	48	45
46	46	51	43	47	44	52	49	53	52
55	54	48	53	54	42	49	50	42	48

- (i) Tabulate the number of computer terminals in a frequency distribution table using six classes.
(ii) Using the frequency distribution table in (i) find the three quartiles.

[10 marks]

2. Customers are used to evaluate preliminary product designs. In the past, 95% of highly successful products received good reviews, 60% of moderately successful products received good reviews, and 10% of poor products received good reviews. In addition, 40% of products have been highly successful, 35% have been moderately successful, and 25% have been poor products.

- (i) What is the probability that a product attains a good review?
(ii) If a new design attains a good review, what is the probability that it will be a highly successful product?
(iii) If a product does not attain a good review, what is the probability that it will be highly successful product?

[8 marks]

3. The percentage of people exposed to a bacteria who become ill is 20%. Assume that people are independent. Assume that 1000 people are exposed to the bacteria. Approximate each of the following;

- (i) The probability that more than 225 become ill
(ii) The probability that between 175 and 225 become ill
(iii) The value such that the probability that the number of people that become ill exceeds the value is 0.01

[10 marks]

1. *Data berikut menunjukkan bilangan terminal komputer yang dihasilkan oleh Syarikat SYAWALIS untuk sampel 30 hari*

50	51	52	47	41	52	56	44	48	45
46	46	51	43	47	44	52	49	53	52
55	54	48	53	54	42	49	50	42	48

- (i) *Susunkan bilangan terminal komputer dalam jadual taburan frekuensi menggunakan enam kelas.*
 (ii) *Cari ketiga-tiga kuartil dengan menggunakan jadual taburan frekuensi di (i).*

[10 markah]

2. *Rekabentuk awal produk akan dinilai oleh para pelanggan. Pada masa lalu, 95% produk yang sangat berjaya akan menerima ulasan baik, 60 % produk yang sederhana berjaya akan menerima ulasan baik dan 10% produk yang kurang berjaya akan menerima ulasan baik. Tambahan pula, 40% produk adalah sangat berjaya, 35% produk sederhana berjaya dan 25% produk kurang berjaya.*

- (i) *Apakah kebarangkalian suatu produk akan mendapat ulasan baik?*
 (ii) *Jika rekabentuk suatu produk baru mendapat ulasan baik, apakah kebarangkalian produk itu adalah produk yang sangat berjaya?*
 (iii) *Jika produk tidak mendapat ulasan baik, apakah kebarangkalian produk itu adalah produk yang sangat berjaya?*

(8 markah)

3. *Peratusan orang yang terdedah kepada suatu bakteria dan sakit adalah 20%. Anggapkan orang adalah tak bersandar. Anggapkan juga 1000 orang telah terdedah kepada bakteria tersebut. Anggarkan setiap yang berikut;*

- (i) *Kebarangkalian lebih daripada 225 orang sakit.*
 (ii) *kebarangkalian antara 175 dan 225 orang sakit.*
 (iii) *Suatu nilai di mana kebarangkalian bilangan orang yang sakit melebihi nilai tersebut adalah 0.01.*

[10 markah]

4. The fill volume of an automated filling machine used for filling cans of carbonated beverage is normally distributed with a mean of 12.4 fluid ounces and a variance of 0.01 fluid ounce.
- What is the probability a fill volume is less than 12 fluid ounces?
 - If all cans less than 12.1 or greater than 12.6 ounces are scrapped, what proportion of cans is scrapped?
 - Determine specifications that are symmetric about the mean that include 99% of all cans.

[10 marks]

5. Buses arrive at Saujana bus stop every 15-minute to take students to lecture hall starting at 7am. That is, they arrive at 7, 7:15, 7:30, 7:45 and so on. If a student arrives at the bus stop at a time that is uniformly distributed between 7 and 7:30, find the probability that he or she waits
- less than 5 minutes for a bus
 - more than 10 minutes for a bus

[8 marks]

6. (a) Women's heights are normally distributed with a mean of 63.6 inch and a variance of 6.25 inch. How many women must be surveyed if we want to estimate the percentage who are taller than 60 inch? Assume that we want 98% confidence that the error is no more than 2.5 percentage points.
- (b) A 95% confidence interval is given by $19.1 \leq \sigma \leq 45.8$, If $n=12$, find the value of the standard deviation, s .

[10 marks]

7. The table below show the weight of 125 randomly selected primary school students'bags at Sekolah Kebangsaan Sungai Gelugor . Given that the estimated mean and variance of the bags weight are 10.94 kg and 0.0818 kg, is it reasonable to model the school bag weights as being normally distributed?

$(-\infty, 10.54]$	$(10.54, 10.74]$	$(10.74, 10.94]$	$(10.94, 11.14]$	$(11.14, 11.34]$	$(11.34, \infty)$
10	25	28	35	18	9

[12 marks]

4. Isipadu pengisian sebuah mesin pengisian secara automatik untuk minuman tin berkarbonat adalah bertaburan secara normal dengan purata 12.4 auns cecair dan varians 0.01 auns cecair.

- (i) Apakah kebarangkalian isipadu isian kurang daripada 12 auns cecair?
- (ii) Jika kesemua tin yang kurang daripada 12.1 dan lebih daripada 12.6 auns adalah rosak, apakah kadaran tin yang rosak?
- (iii) Tentukan spesifikasi yang simetri pada purata yang mengandungi 99% daripada kesemua tin.

[10 markah]

5. Bas-bas tiba di perhentian bas Saujana setiap 15 minit untuk mengambil pelajar dan menghantar ke dewan kuliah bermula jam 7 pagi, iaitu bas tiba pada pukul 7, 7:15, 7:30, 7:45 dan seterusnya. Jika seorang pelajar tiba di perhentian bas pada masa yang tertabur secara seragam antara 7:00 dan 7:30, cari kebarangkalian bahawa dia perlu tunggu

- (i) bas kurang daripada 5 minit
- (ii) bas lebih daripada 10 minit

[8 markah]

6. (a) Ketinggian wanita adalah tertabur secara normal dengan purata 63.6 inci dan varians 6.25 inci. Berapakah bilangan wanita yang perlu disoal selidik jika kita ingin menganggar peratusan wanita yang tinggi lebih daripada 60 inci? Anggapkan kita ingin 98% yakin bahawa ralat adalah tidak melebihi 2.5 peratus.

(b) Suatu selang keyakinan 95% diberikan oleh $19.1 \leq \sigma \leq 45.8$, Jika $n=12$, cari nilai sisihan piawai, s .

[10 markah]

7. Jadual di bawah menunjukkan berat beg 125 pelajar sekolah rendah yang dipilih secara rawak dari Sekolah Kebangsaan Sungai Gelugor. Diberikan anggaran purata dan varians berat beg-beg adalah 10.94 kg dan 0.0818 kg, adakah munasabah jika berat beg dimodelkan sebagai tertabur secara normal?

$(-\infty, 10.54]$	$(10.54, 10.74]$	$(10.74, 10.94]$	$(10.94, 11.14]$	$(11.14, 11.34]$	$(11.34, \infty]$
10	25	28	35	18	9

[12 markah]

8. The drug Viagra has become quite well known, and it has had a substantial economic impact on its producer, Pfizer Pharmaceuticals. In preliminary tests for adverse reactions, it was found that when 734 men were treated with Viagra, 16% of them experienced headaches (there's some real irony there). Among 725 men in a placebo group, 4% experienced headaches (based on data from Pfizer Pharmaceuticals).
- Using a 0.01 significance level, is there sufficient evidence to support the claim that among those men who take Viagra, headaches occur at a rate that is greater than the rate for those who do not take Viagra?
 - Construct a 99% confidence interval estimate of the difference between the rate of headaches among Viagra users and the headache rate for those who are given a placebo. What does the confidence interval suggest about the two rates?

[12 marks]

9. A researcher obtains a random sample of 24 students taking elementary statistics at a university and divides them randomly into two groups. Group A receives instruction to use Software A to do statistics assignment, while Group B is taught to use software B to do the same assignment. The time (in minutes) taken by each student to complete this assignment is given in the table.

Group A	123	101	112	85	87	133	129	114	150	110	180	115
Group B	65	115	95	100	94	72	60	110	99	102	88	97

Using a suitable nonparametric test at 5% level of significance, can you conclude that the mean time required for all students taking elementary statistics at this university to complete this assignment is longer for Software A than for software B?

[14 marks]

10. A certain elevator in the library on a university campus has a sign in the elevator that indicates maximum legal carrying capacity of 6000 pounds. Suppose that the population of all people who ride this elevator have a mean weight of 160 pounds with a standard deviation of 25 pounds. If 35 of these people (assume randomly selected from the population) board the elevator,
- What are the mean and standard deviation of the sampling distribution of the sample mean weight?
 - What is the probability that their combined weight will exceed 6000 pounds?

[6 marks]

8. Ubat Viagra telah mulai dikenali dan ini memberi kesan langsung kepada ekonomi syarikat pengeluarannya, Pfizer Pharmaceuticals. Dalam suatu kajian awal reaksi tentangan, didapati 734 lelaki yang mengambil Viagra, 16% akan mengalami sakit kepala (ada kesan kesakitan). Pada kalangan 725 lelaki yang mengambil ubat 'placebo' 4% mengalami sakit kepala (berdasarkan data Pfizer Pharmaceuticals)
- (i) Menggunakan aras keertian 0.01, adakah terdapat bukti yang mencukupi untuk menyokong tuntutan bahawa pada kalangan lelaki yang mengambil Viagra, kadar berlakunya sakit kepala lebih tinggi berbanding mereka yang tidak mengambil Viagra?
- (ii) Bina selang keyakinan 99% untuk anggaran perbezaan kadar sakit kepala pada kalangan pengguna Viagra dan kadar sakit kepala mereka yang diberikan 'placebo'. Apakah cadangan selang keyakinan berdasarkan kedua-dua kadar?

[12 markah]

9. Seorang penyelidik mengambil sampel 24 orang pelajar yang mengikuti statistik asas di sebuah universiti dan membahagikan kepada dua kumpulan. Kumpulan A menerima arahan menggunakan Perisian A untuk membuat tugas statistik, manakala Kumpulan B diajar menggunakan Perisian B untuk menyelesaikan tugas tersebut. Masa (dalam minit) untuk menyiapkan tugas diambil bagi setiap pelajar dan diberikan dalam jadual di bawah.

Kumpulan A	123	101	112	85	87	133	129	114	150	110	180	115
Kumpulan B	65	115	95	100	94	72	60	110	99	102	88	97

Menggunakan ujian tak berparameter yang sesuai pada aras keertian 5%, bolehkah kita membuat kesimpulan bahawa masa yang diperlukan untuk menyelesaikan tugas oleh kesemua pelajar yang mengikuti statistik asas di universiti ini adalah lebih lama bagi Perisian A berbanding Perisian B?

[14 markah]

10. Suatu lif dalam perpustakaan di sebuah kampus universiti mempunyai tanda dalam lif yang menunjukkan kapasiti maksimum yang dibenarkan adalah 6000 paun. Andaikan populasi orang yang menggunakan lif tersebut mempunyai purata berat 160 paun dengan sisihan piawai 25 paun. Jika 35 orang (anggapkan dipilih secara rawak dari populasi) telah menggunakan lif tersebut.
- (i) Apakah purata dan sisihan piawai bagi taburan persampelan purata berat sampel.
- (ii) Apakah kebarangkalian bahawa berat gabungan akan melebihi 6000 paun?

[6 markah]

APPENDIX

$$Q_r = b' + \frac{c \left(\frac{rn}{4} - l' \right)}{f_Q}$$

$$\bar{x} \pm \frac{Z_{\alpha/2} \sigma}{\sqrt{n}}$$

$$\bar{x} \pm \frac{t_{n-1, \alpha/2} s}{\sqrt{n}}$$

$$(\bar{X} - \bar{Y}) \pm Z_{\alpha/2} \sqrt{\frac{\sigma_x^2}{n_x} + \frac{\sigma_y^2}{n_y}}$$

$$(\bar{X} - \bar{Y}) \pm t_{\alpha/2, (n_x + n_y - 2)} S_p \sqrt{\frac{1}{n_x} + \frac{1}{n_y}}$$

$$S_p^2 = \frac{(n_x - 1)s_x^2 + (n_y - 1)s_y^2}{n_x + n_y - 2}$$

$$(\hat{p}_x - \hat{p}_y) \pm Z_{\alpha/2} \sqrt{\frac{\hat{p}_x(1-\hat{p}_x)}{n_x} + \frac{\hat{p}_y(1-\hat{p}_y)}{n_y}} \left(\frac{s_x^2}{s_y^2} \frac{1}{f_{\alpha/2}(v_x, v_y)}, \frac{s_x^2}{s_y^2} f_{\alpha/2}(v_y, v_x) \right) \left(\frac{(n-1)s^2}{\chi_{n-1, \alpha/2}^2}, \frac{(n-1)s^2}{\chi_{n-1, 1-\alpha/2}^2} \right)$$

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$T = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$Z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$$

$$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2}$$

$$Z = \frac{(\bar{X} - \bar{Y})}{\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}}$$

$$T = \frac{(\bar{X} - \bar{Y})}{S_p \sqrt{\frac{1}{n_x} + \frac{1}{n_y}}}$$

$$T = \frac{\bar{d} - \mu_d}{s_d/\sqrt{n}}$$

$$Z = \frac{\hat{p}_x - \hat{p}_y}{\sqrt{pq \left(\frac{1}{n_x} + \frac{1}{n_y} \right)}}$$

$$F = \frac{s_1^2}{s_2^2}$$

$$\chi^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}$$

$$z = \frac{W - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}}$$

$$U_1 = n_1 n_2 + \frac{(n_2)(n_2 + 1)}{2} - R_2$$

$$U_2 = n_1 n_2 + \frac{(n_1)(n_1 + 1)}{2} - R_1$$

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}}$$