FINAL EXAMINATION / *PEPERIKSAAN AKHIR*
SEMESTER II – SESSION 2020 / 2021
PROGRAM KERJASAMA

COURSE CODE   : DDWG 2213
KOD KURSUS

COURSE NAME   : BUSINESS STATISTICS
NAMA KURSUS   *STATISTIK PERNIAGAAN*

YEAR / PROGRAMME : 2 DDWG
TAHUN / PROGRAM

DURATION   : 3 HOURS
TEMPOH   *3 JAM*

DATE   : APRIL / MAY 2021
TARIKH   *APRIL /MEI 2021*

INSTRUCTION / *ARAHAN:*

1.   Answer **ALL** questions in **Part A** and only **TWO** (2) questions in **Part B**.
     Write your answers on the answer sheet
     *Jawab **SEMUA** soalan di **Bahagian A** dan hanya **DUA** (2) soalan di **Bahagian B**.*
     Tulis jawapan anda pada kertas jawapan.

2.   A list of statistics formula is attached for reference.
     Senarai rumus statistik dilampirkan sebagai rujukan.

3.   Write your name, matric no., identity card no., course code, course name, section no.
     and lecturer's name on the first page (in the upper left corner) and every page thereafter
     on the answer sheet.
     Tulis nama anda, no. matrik, no. kad pengenalan, kod kursus, nama kursus, no. seksyen
     dan nama pensyarah pada muka surat pertama (penjuru kiri atas) kertas jawapan dan
     pada setiap muka surat jawapan.

4.   Each answer sheet must have a page number written at the bottom right corner.
     Setiap helai kertas jawapan mesti ditulis nombor muka surat pada bahagian bawah
     penjuru kanan.

5.   Answers should be handwritten, neat and clear.
     Jawapan hendaklah ditulis tangan, kemas dan jelas menggunakan huruf cerai.

This examination paper consists of **11** pages including the cover.
*Kertas soalan ini mengandungi **11** muka surat termasuk kulit hadapan.*

ONLINE EXAMINATION RULES AND REGULATIONS
PERATURAN PEPERIKSAAN SECARA DALAM TALIAN

1. Student must carefully listen and follow instructions provided by invigilator.
   Pelajar mesti mendengar dan mengikuti arahan yang diberikan oleh pengawas peperiksaan dengan teliti.

2. Student is allowed to start examination only after confirmation of invigilator if all needed conditions are implemented.
   Pelajar dibenarkan memulakan peperiksaan hanya setelah pengesahan pengawas peperiksaan sekiranya semua syarat yang diperlukan telah dilaksanakan.

3. During all examination session student has to ensure, that he is alone in the room.
   Semasa semua sesi peperiksaan pelajar harus memastikan bahawa dia bersendirian di dalam bilik.

4. During all examination session student is not allowed to use any other devices, applications except other sites permitted by course lecturer.
   Sepanjang sesi peperiksaan pelajar tidak dibenarkan menggunakan peranti dan aplikasi lain kecuali yang dibenarkan oleh pensyarah kursus.

5. After completing the exam student must inform invigilator via the set communication platform (eg. WhatsApp etc.) about completion of exam and after invigilator's confirmation leave examination session.
   Selepas peperiksaan selesai, pelajar mesti memaklumkan kepada pengawas peperiksaan melalui platform komunikasi yang ditetapkan (contoh: Whatsapp dan lain-lain) mengenai peperiksaan yang telah selesai dan meninggalkan sesi peperiksaan selepas mendapat pengesahan daripada pengawas peperiksaan.

6. Any technical issues in submitting answers online have to be informed to respective lecturer within the given 30 minutes. Request for re-examination or appeal will not be entertain if complains are not made by students to their lecturers within the given 30 minutes.
   Sebarang masalah teknikal dalam menghantar jawapan secara dalam talian perlu dimaklumkan kepada pensyarah masing-masing dalam masa 30 minit yang diberikan. Permintaan untuk pemeriksaan semula atau rayuan tidak akan dilayan sekiranya aduan tidak dibuat oleh pelajar kepada pensyarah mereka dalam masa 30 minit yang diberikan.

7. During online examination, the integrity and honesty of the student is also tested. At any circumstances student is not allowed to cheat during examination session. If any kind of cheating behaviour is observed, UTM have a right to follow related terms and provisions stated in the respective Academic Regulations and apply needed measures.
   Semasa peperiksaan dalam talian, integriti dan kejujuran pelajar juga diuji. Walau apa pun keadaan pelajar tidak dibenarkan menipu semasa sesi peperiksaan. Sekiranya terdapat sebarang salah laku, UTM berhak untuk mengikuti terma yang dinyatakan dalam Peraturan Akademik.

Section A: Answer ALL questions.   **(40 Marks / *Markah*)**
(Bahagian A: Jawab SEMUA soalan).

Q1.   The following ordered data are collected from 20 city restaurants for the cost of one
       meal (in RM).
       Data yang tersusun berikut diambil daripada 20 restoran di bandar bagi kos untuk
       setiap hidangan (dalam RM).

25	26	29	32	33	33	35	35	37	39
43	43	43	44	45	48	50	51	53	54

   (a) Calculate the sample mean, median, mode and standard deviation of the data.
       Tentukan min,median,mod dan sisihan piawai untuk sampel bagi data.

   (b) Calculate the coefficient of skewness. Are the data symmetric or skewed?
       Kirakan pekali bagi kepencongan. Adakah data simetri atau terpencong?

                                                                          [8 M]

Q2.   Do males or females feel more stressed out at work? A survey of employed adults
       conducted online revealed the following in Table 1.
       Adakah lelaki atau wanita merasai lebih tertekan di tempat kerja? Tinjauan
       terhadap pekerja dewasa dijalankan melalui talian mendedahkan perkara berikut
       dalam Jadual 1.

Gender / *Jantina*	Felt Stressed Out At Work *Merasa Tertekan Di Tempat Kerja*	
	Yes / *Ya*	No / *Tidak*
Male *Lelaki*	244	494
Female *Wanita*	282	480

Table 1 / *Jadual 1*

One of these 1500 employed adults is selected at random. Find the probability that:

Salah seorang daripada 1500 pekerja dewasa dipilih secara rawak.

Cari kebarangkalian bahawa:

(a) The selected employed adult felt stressed out at work was a female.

    Pekerja dewasa terpilih merasa tertekan di tempat kerja adalah wanita.

(b) The selected adult was a male and felt stressed out at work.

    Pekerja dewasa terpilih adalah lelaki dan merasa tertekan di tempat kerja.

(c) The selected adult was a female or she felt not stressed out at work.

    Pekerja dewasa terpilih adalah wanita atau dia merasa tidak tertekan di tempat kerja.

(d) Given that the employed adult is male, he felt stressed out at work.

    Diketahui pekerja dewasa adalah lelaki, dia merasa tertekan di tempat kerja.

[8 M]

Q3. A report announced that the mean sales price of new houses sold in a year was $ 280,000. Assume that the prices is normally distributed and the standard deviation is $100,000.

Satu laporan mengumumkan bahawa min harga jualan rumah baru terjual dalam satu tahun adalah $280,000. Anggap bahawa harga tertabur secara normal dan sisihan piawai ialah $100,000.

(a) What is the probability that the price of new houses is less than $300,000.

    Apakah kebarangkalian bahawa harga rumah baru kurang daripada $300,000.

(b) If you select a random sample of 100 new houses, what is the probability that the sample mean will be between $290,000 and $350,000?

    Jika anda memilih sampel rawak 100 rumah baru, apakah kebarangkalian bahawa min sampel di antara $290,000 dan $350,000?

[8 M]

Q4. A pizza store franchise has found the following data, Table 2, which shows the number of employees at its various stores across the country, y, and the time (months) for which each store has been operated, x .

Satu rangkaian kedai pizza memperolehi data berikut, Jadual 2, yang menunjukkan bilangan pekerja di setiap kedai di seluruh negeri , y , dan masa (bulan) bagi setiap kedai telah beroperasi , x .

Length of time has been operated *Jangka masa kedai beroperasi*	Current number of employee *Bilangan pekerja semasa*
14	15
4	2
36	25
30	22
22	21
12	10
18	16
28	20
30	24
36	24

Table 2 / *Jadual 2*

(a) Calculate the coefficient of correlation between length of time the stores has been operated and the number of employees.

Kira pekali bagi korelasi antara jangka masa kedai telah beroperasi dan bilangan pekerja.

(b) Compute the regression coefficients a *and* b. Write the least square regression line to predict the number of employees.

Kira pekali regresi a dan b. Tuliskan persamaan garis regresi kuasa dua terkecil untuk meramalkan bilangan pekerja.

(c) Predict the number of employees at a store which has been operated for 35 months.

Ramalkan bilangan pekerja sebuah kedai yang telah beroperasi selama 35 bulan.   **[8 M]**

Q5.   A semiconductor firm purchases an identical component from three independent suppliers that differ in unit price and quantity supplied. The data from 2012 and 2015 are given in Table 3.

Satu firma semikonduktor membeli komponen yang sama daripada tiga pembekal bebas berbeza dari segi harga unit dan kuantiti yang dibekalkan. Data dari tahun 2012 dan 2015 diberikan dalam Jadual 3.

Supplier	Quantity / *Kuantiti*		Unit Price / *Harga Unit*	
Pembekal	2012	2015	2012	2015
A	1500	2500	5.45	6.00
B	2000	2700	5.60	5.95
C	1200	2000	5.50	6.20

Table 3 / *Jadual 3*

(a)   Calculate the aggregate price index for all components for 2015.

Kira agregat indeks harga untuk semua komponen bagi 2015.

(b)   Calculate and interpret the Laspeyres price index for 2015.

Kira dan huraikan indeks harga Laspeyres bagi 2015.

(c)   Calculate and interpret the Paasche price index for 2015.

Kira dan huraikan indeks harga Paasche bagi 2015.

[8 M]

Section B: Answer only TWO (2) questions.   **(20 Marks / *Markah*)**
(Bahagian B: Jawab hanya DUA (2) soalan).

Q1.   The owner of a coffee shop wants to study coffee purchasing habits of customers at her shop. She selects a random of 60 customers during a certain week. The results stated that the amount spent has a sample mean $7.25 and a standard deviation $1.75.
Pemilik sebuah kedai kopi mahu mengkaji tabiat membeli kopi pelanggan di kedainya. Dia memilih rawak 60 pelanggan dalam minggu tertentu. Keputusan menyatakan bahawa jumlah yang dibelanjakan mempunyai min sampel $7.25 dan sisihan piawai $1.75.

(a) At $\alpha = 0.02$ level of significance, test is there evidence that the population mean was different from $6.50.
Pada tahap keertian α = 0.02, uji samada terdapat bukti bahawa min populasi adalah berbeza daripada $6.50.

(b) If the sample mean equals $7.00, what is your decision compare to (a)?
Jika min sampel $7.00, apakah keputusan anda berbanding (a)?

[10 M]

Q2.   A survey shows the average insurance cost to a company per employee hour is $1.84 for managers and $1.99 for professional specialty workers.Suppose these figures were obtained from 35 managers and 41 professional specialty workers and that their respective population standard deviations are $0.38 and $0.51. Test to determine whether there is significant difference in the hourly rates employers pay for the insurance between managers and professional specialty workers.
Use a 5% level of significance.
Satu kajian menunjukkan kos purata insurans syarikat sejam bagi setiap pekerja adalah $1.84 bagi pengurus dan $1.99 bagi pekerja khas profesional. Katakan angka ini diperolehi daripada 35 pengurus dan 41 pekerja khas profesional dan sisihan piawai populasi masing-masing adalah $0.38 dan $0.51. Uji bagi menentukan samada terdapat perbezaan yang ketara dalam kadar insurans setiap jam majikan bayar di antara pengurus dan pekerja khas profesional. Gunakan tahap keertian pada 5%.

[10 M]

Q3.   A company has three manufacturing plants, and company officials want to determine
whether there is a difference in the average ages of workers at the three locations. The
computations shown in the ANOVA in Table 5 are the summary data for the ages of
five randomly selected workers at each plant.

*Sebuah syarikat mempunyai tiga kilang pembuatan dan pegawai syarikat ingin
menentukan samada terdapat perbezaan dalam purata umur pekerja di tiga lokasi.
Pengiraan ditunjukkan ANOVA dalam Jadual 5 adalah ringkasan data bagi umur
lima pekerja yang dipilih secara rawak di setiap kilang.*

Source of Variation *Sumber Variasi*	df *dk*	Sum of Squares *Kuasa dua Jumlah*	Mean of Squares *Kuasa dua Min*
Between/ *Antara*	2	129.73	
Error/ *Ralat*		19.60	
Total/ *Jumlah*	14		

Table 5 / *Jadual 5*

(a)   Complete and copy the above ANOVA summary table.
       Lengkapkan dan salin jadual ringkasan ANOVA di atas.

(b)   How many workers were involved in this survey?
       Berapa bilangan pekerja yang terlibat dalam kajiselidik ini?

(c)   Determine whether there is a significant difference in the mean ages of the
       workers at the three plants.Test at 5% level of significance.
       *Tentukan samada terdapat perbezaan ketara dalam min usia bagi pekerja
       di ketiga-tiga kilang.Uji pada tahap keertian 5%.*   **[10 M]**

END OF QUESTIONS / *SOALAN TAMAT*

END OF QUESTIONS / *SOALAN TAMAT*
LIST OF FORMULA

DESCRIPTIVE STATISTICS

For Ungrouped Data:

Mean, $\bar{x} = \dfrac{\sum x}{n}$ Variance, $s^2 = \dfrac{n \sum x^2 - (\sum x)^2}{n(n-1)}$

For Grouped Data:

Mean, $\bar{x} = \dfrac{\sum fx}{\sum f}$ Variance, $s^2 = \dfrac{1}{(\sum f)-1}\left[\sum fx^2 - \dfrac{(\sum fx)^2}{\sum f}\right]$

Median, $\tilde{x} = L + \dfrac{\frac{(\sum f)+1}{2} - f_L}{f_m} \times C$ Mode, $\hat{x} = L + \left(\dfrac{d_1}{d_1+d_2}\right) \times C$

MEASURES OF DISPERSION

Coefficient of Variance, $CV = \dfrac{s}{\bar{x}} \times 100\%$

Coefficient of Skewness, $s_k = \dfrac{\bar{x}-mode}{s}$ or $s_k = \dfrac{3(\bar{x}-median)}{s}$

BASIC PROBABILITY

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$

PROBABILITY DISTRIBUTIONS

$X \sim N(\mu, \sigma^2) \quad \rightarrow \quad Z \sim N(0,1) \; ; \quad Z = \dfrac{X-\mu}{\sigma}$

$\bar{X} \sim N(\mu_{\bar{x}}, \sigma_{\bar{x}}^2) = N\left(\mu, \dfrac{\sigma^2}{n}\right) \quad \rightarrow \quad Z \sim N(0,1) \; ; \quad Z = \dfrac{\bar{X}-\mu}{\sigma/\sqrt{n}}$

$X \sim B(n,p) \text{ approximates to } X \sim N(\mu, \sigma^2) \rightarrow X \sim N(np, npq) \; ; \; Z = \dfrac{X-np}{\sqrt{npq}}$

HYPOTHESIS TESTING: ONE-SAMPLE TESTS

Z-test: $Z = \dfrac{\bar{X}-\mu}{\sigma/\sqrt{n}}$, σ known   t-test: $t = \dfrac{\bar{X}-\mu}{s/\sqrt{n}}$; $df = n-1$, σ unknown and $n < 30$

Critical values for Z-distribution:

α	Z_α	$z_{\alpha/2}$
0.01	2.3263	2.5758
0.025	1.9600	2.2400
0.05	1.6449	1.9600
0.005	2.5758	2.8100

HYPOTHESIS TESTING: TWO-SAMPLE TESTS

Z-test for two independent samples: Z-test for two independent large samples:

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}} \qquad\qquad z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s^2}{n_2}}}$$

t-test for two independent samples (equal population standard deviations):

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{S_p^2}{n_1} + \dfrac{S_p^2}{n_2}}}$$

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

t-test for two dependent samples:

$$t = \frac{\bar{d} - d_0}{s_d/\sqrt{n}} \qquad where \qquad s_d = \sqrt{\frac{\sum d^2 - \left(\frac{\sum d}{n}\right)^2}{n - 1}} \quad and \quad \bar{d} = \frac{\sum d_i}{n}$$

ANALYSIS OF VARIANCE (ANOVA)

ANOVA test:

$$SSB = SSTr = \sum \left(\frac{T_c^2}{n_c}\right) - \frac{(\sum X)^2}{n}$$

$$SSTotal = \sum X^2 - \frac{(\sum X)^2}{n}$$

$$SSTotal = SSTr + SSE = SSB + SSW$$

$$MSTr = \frac{SSTr}{k - 1}$$

$$MSE = \frac{SSE}{n - k}$$

$$F = \frac{MSTr}{MSE}$$

CHI-SQUARE ANALYSIS

χ^2-test:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad with \quad E_i = np_i$$

ANOVA SUMMARY TABLE

Source	Degrees of Freedom	Sum of Squares	Mean Squares (Variance)	F
Between treatments	k-1	SSA	MSTR=SSA/(k-1)	MSTR/MSE
Error(within treatments)	n- k	SSE	MSE=SSE/(n-k)	
Total	n-1	SST		

REGRESSION ANALYSIS

Simple Linear Regression:

$$\hat{y} = a + bx, \quad \text{where } b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} \quad \text{and} \quad a = \frac{\sum y}{n} - b\frac{\sum x}{n}$$

Pearson Product-Moment Correlation Coefficient:

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Coefficient of Determination $= r^2$

INDEX NUMBERS

Relative Price	Relative Quantity	Average Price	Aggregate Price
$I = \frac{p_t}{p_o} \times 100$	$I = \frac{q_t}{q_o} \times 100$	$I = (\sum \frac{p_t}{p_0} \times 100)/k$	$I = \frac{\sum p_t}{\sum p_0} \times 100$
Laspeyres Price	Laspeyres Quantity	Paasche Price	Paasche Quantity

$$= \frac{\sum p_t q_o}{\sum p_o q_o} \times 100 \qquad L = \frac{\sum p_t q_o}{\sum p_o q_o} \times 100 \qquad L = \frac{\sum q_t p_o}{\sum q_o p_o} \times 100 \qquad P = \frac{\sum p_t q_t}{\sum p_o q_t} \times 100 \qquad P =$$

$$\frac{\sum q_t p_t}{\sum q_o p_t} \times 100$$