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# UNIVERSITI SAINS MALAYSIA

First Semester Examination  
2014/2015 Academic Session

December 2014 / January 2015

## EBB 300/2 – Engineering Statistics [Statistik Kejuruteraan]

Duration : 2 hours  
[Masa : 2 jam]

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Please ensure that this examination paper contains TWENTY TWO printed pages before you begin the examination.

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

This paper consists of SIX questions. THREE questions in PART A and THREE questions in PART B.

*[Kertas soalan ini mengandungi ENAM soalan. TIGA soalan di BAHAGIAN A dan TIGA soalan di BAHAGIAN B.]*

**Instruction:** Answer **FOUR** questions. Answer **TWO** questions from PART A and **TWO** questions from PART B. If a candidate answers more than four questions only the first four questions answered in the answer script would be examined.

*[Arahan: Jawab **EMPAT** soalan. Jawab **DUA** soalan dari BAHAGIAN A dan **DUA** soalan dari BAHAGIAN B. Jika calon menjawab lebih daripada empat soalan hanya empat soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]*

The answers to all questions must start on a new page.

*[Mulakan jawapan anda untuk semua soalan pada muka surat yang baru.]*

You may answer a question either in Bahasa Malaysia or in English.

*[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

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

*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]*

PART A / BAHAGIAN A

1. [a] A steel manufacturing firm has had a chronic problem of scrap and rework in the wire mill. The total cost of the scrap and rework was shocked the top management. As a process engineer, you are assigned to rectify this problem.

*Sebuah kilang keluli mempunyai masalah dalam sekerap dan kerja semula pengisaran wayar. Kos keseluruhan untuk sekerap dan kerja semula telah memeranjatkan pihak pengurusan atasan. Sebagai jurutera proses, anda ditugaskan untuk mengatasi masalah ini.*

- (i) List down the general approach (5 phases) that you will be carried out to rectify the scrap and rework problem.

*Senaraikan pendekatan umum (5 fasa) yang akan anda gunakan untuk mengatasi masalah sekerap dan kerja semula.*

(10 marks/markah)

- (ii) Discuss briefly the objectives, activities and statistical tools you are likely to use in each phases.

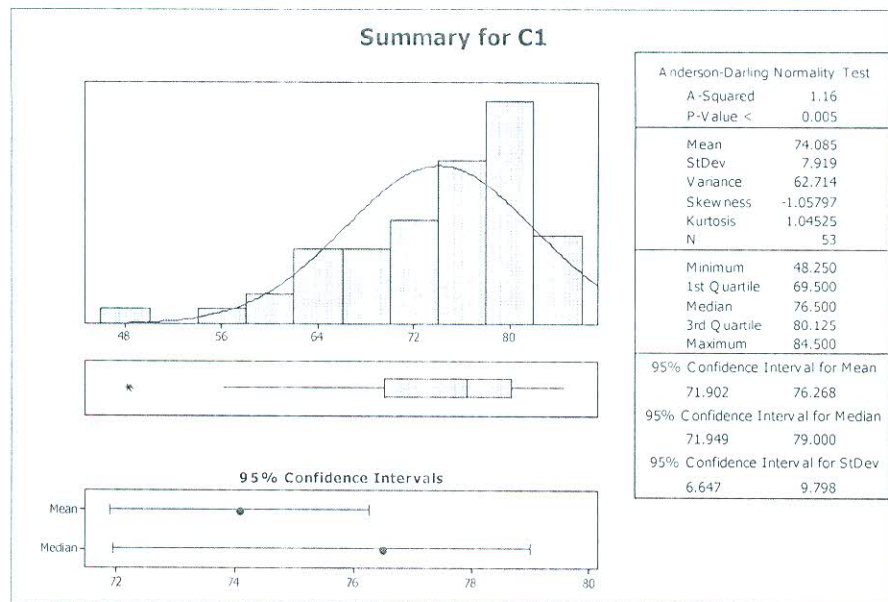
*Bincang secara ringkas objektif, aktiviti dan alat statistik yang anda akan gunakan dalam setiap fasa tersebut.*

(30 marks/markah)

- [b] The test score of science in a secondary school is shown in Figure 1. Is it reasonable to assume that this data is from a normal distribution? Justify your answer.

*Skor ujian sains bagi sebuah sekolah menengah ditunjukkan dalam Rajah 1. Adakah munasabah untuk menganggap data ini adalah bertaburan normal? Justifikasikan jawapan anda.*

(30 marks/markah)



**Figure 1 - Minitab output and summary for a science subject**

*Rajah 1 - Output Minitab dan ringkasan untuk subjek sains*

- [c] As a quality control engineer, you need to ensure that the purity of raw materials, i.e. alumina must be greater than 85%. A random sample from a recent shipment of alumina yielded the following results (in %): 93.2, 87.0, 92.1, 90.1, 87.3 and 93.6%. Carry out the hypothesis testing to determine if you should receive the shipment. Given  $\alpha = 0.05$ .

*Sebagai seorang jurutera kawalan kualiti, anda perlu memastikan ketulenan bahan mentah yang diterima, iaitu alumina melebihi 85%. Suatu sampel rawak daripada penghantaran alumina terkini mempunyai keputusan berikut (dalam %): 93.2, 87.0, 92.1, 90.1, 87.3 and 93.6%. Jalankan pengujian hipotesis untuk menentukan sama ada anda perlu menerima penghantaran tersebut. Diberi  $\alpha = 0.05$ .*

(30 marks/markah)

2. [a] A factory produces bolts that will be used in an application that requires a torque of 100 J. A quality manager sampled 12 units of bolts before shipment and measured the torque needed to break each of them. This batch of bolts will ship to the customer if the manager find out that less than 1% of the bolts have a breaking torque of less than 100 J. If the 12 units of bolts have the breaking torque of 108, 110, 112, 114, 114, 115, 115, 116, 118, 120, 123 and 140 J,

*Sebuah kilang menghasilkan bolt yang akan digunakan untuk aplikasi yang memerlukan kilasan sebanyak 100 J. Pengurus kualiti kilang tersebut telah mengambil sampel sebanyak 12 unit bolt sebelum penghantaran dan mengukur kilasannya bagi mematahkan setiap unit bolt. Kelompok bolt ini akan dihantar kepada pelanggannya jika pengurus kualiti ini mendapati kurang daripada 1% bolt mempunyai kilasan kurang daripada 100 J. Jika 12 unit bolt tersebut mempunyai nilai kilasan sebanyak 108, 110, 112, 114, 114, 115, 115, 116, 118, 120, 123 dan 140 J,*

- (i) calculate the sample mean and standard deviation.

*kirakan purata dan sisihan piawai sampel.*

(30 marks/markah)

- (ii) assume the 12 units bolts were sampled from a normal distribution and assume the sample mean and standard deviation calculated in part 2[a](i) are population mean and standard deviation. Compute the probability of bolts whose breaking torque is less than 100 J.

*anggapkan 12 unit bolt tersebut disampel daripada taburan normal dan anggapkan purata dan sisihan piawai sampel dikirakan di bahagian 2[a](i) adalah purata dan sisihan piawai. Kirakan keberangskalian bolt yang kilasannya patahnya kurang daripada 100 J.*

(20 marks/markah)

- (iii) determine either this batch of bolts to be sent to the customer?

*Tentukan samada kelompok bolt ini akan dihantar kepada pelanggannya?*

(10 marks/markah)

- [b] The diameter of eight ball bearings were 8.4, 8.2, 9.5, 9.3, 8.8, 9.8, 8.5 and 9.1 (mm). Assume the diameters are normally distributed, construct a 98% confident interval for the diameter of ball bearing.

*Diameter bagi lapan unit galas bebola adalah 8.4, 8.2, 9.5, 9.3, 8.8, 9.8, 8.5 dan 9.1 (mm). Anggapkan diameter ini bertaburan normal, binakan selang keyakinan 98% untuk diameter galas bebola ini.*

(40 marks/markah)

3. [a] Discuss two advantages of using ANOVA in process improvement projects.

*Bincangkan dua kebaikan penggunaan ANOVA dalam projek penambahbaikan proses.*

(10 marks/markah)

- [b] The effect of four different types of catalysts (type A, B, C and D) on the concentration of a chemical are being studied. A completely randomized experiment has been done and the analysis of results are shown below ( $\alpha = 0.05$ ):

*Kesan empat jenis pemangkin (jenis A, B, C dan D) pada kepekatan sesuatu kimia dikaji. Suatu eksperimen rawak lengkap telah dilakukan dan keputusan analisis ditunjuk di bawah ( $\alpha = 0.05$ ):*

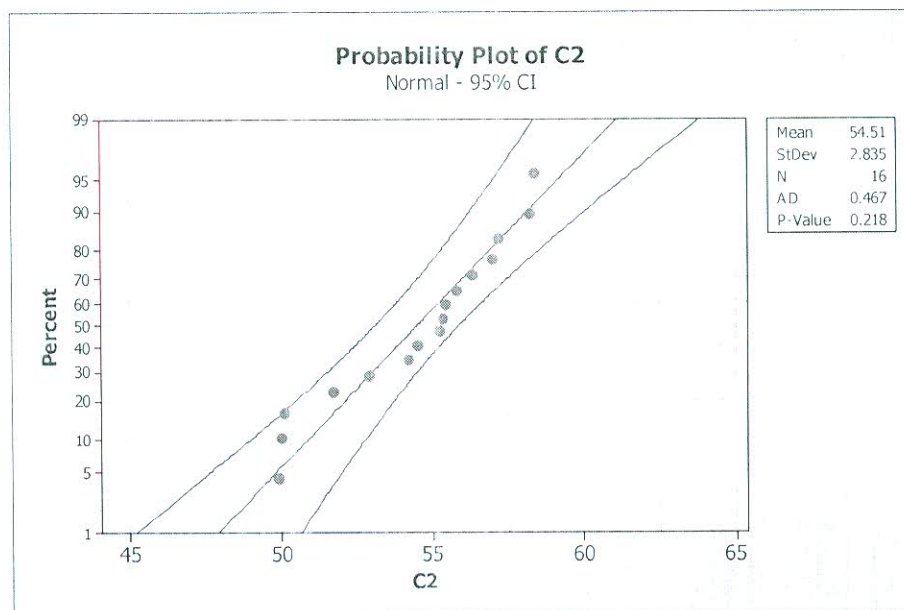
- (i) State the null hypothesis and alternate hypothesis of this experiment.

*Nyatakan hipotesis nol dan hipotesis alternatif bagi eksperimen ini.*

(10 marks/markah)

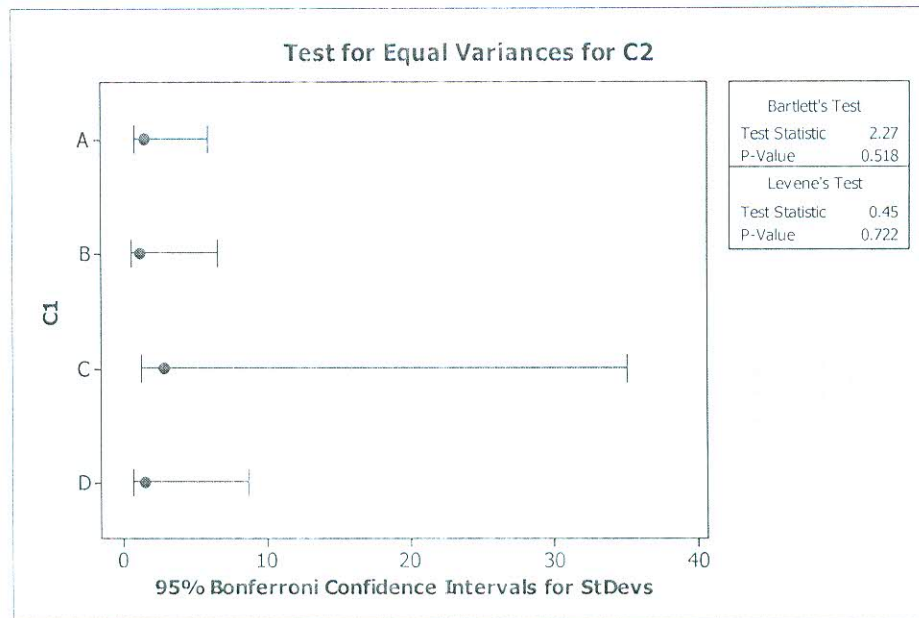
- (ii) The normal probability plot and test for equal variance are shown in Figure 2 and Figure 3, respectively. Do the assumptions for the model hold? Justify your answer.

*Plot keberangkalian normal dan pengujian sama varians ditunjukkan dalam Rajah 2 dan Rajah 3 masing-masing. Adakah anggapan model ini masih dipegang? Justifikasikan jawapan anda.*



**Figure 2 - Normal probability plot**

*Rajah 2 - Plot keberangkalian normal*



**Figure 3 - Test for equal variance**

*Rajah 3 - Pengujian sama varians*

(10 marks/markah)

- (iii) Table 1 shows the ANOVA table of the experiment. Calculate the "X", "Y" and "Z" values in the ANOVA table.

*Jadual 1 menunjukkan jadual ANOVA bagi eksperimen tersebut. Kirakan nilai "X", "Y" dan "Z" dalam jadual ANOVA.*

**Table 1 - ANOVA table***Jadual 1 - Jadual ANOVA***One-way ANOVA: C2 versus C1**

Source	DF	SS	MS	F	P
C1	3	87.14	Y	Z	0.001
Error	12	33.43	2.79		
Total	15	X			

S = 1.669 R-Sq = 72.27% R-Sq(adj) = 65.34%

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev
A	5	56.960	1.424
B	4	55.775	1.100
C	3	53.233	2.779
D	4	51.125	1.443

Pooled StDev = 1.669

(15 marks/markah)

- (iv) Based on the ANOVA table, do the four catalysts have the same effect on the concentration of chemical? Explain your answer?

*Berdasarkan jadual ANOVA ini, adakah keempat-empat jenis pemangkin ini mempunyai kesan yang sama pada kepekatan kimia? Terangkan jawapan anda?*

(5 marks/markah)

- (v) Analyze the residuals from this experiment in Figure 4. Verify if the basic ANOVA assumptions satisfied.

*Buat analisis pada residual daripada eksperimen dalam Rajah 4. Tentukan jika anggapan ANOVA asas telah dipenuhi.*

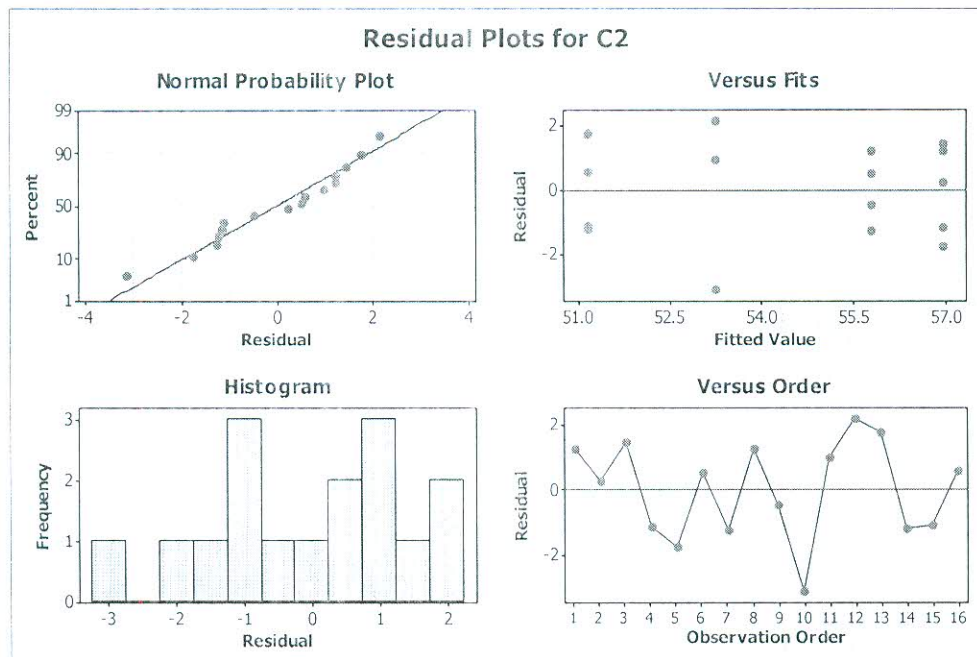


Figure 4 - Residual plots

Rajah 4 - Plot residual

(20 marks/markah)

- (vi) If you wish to produce chemical with the highest concentration, which type of catalyst would you select? Explain your answer.

*Jika anda ingin menghasilkan bahan kimia dengan kepekatan yang tertinggi, jenis pemangkin yang mana akan anda memilih? Terangkan jawapan anda.*

(10 marks/markah)

- (vii) Construct a 99% confident interval to estimate the mean response for catalyst A.

*Binakan selang keyakinan 99% untuk menjangka sambutan mean bagi pemangkin A.*

(20 marks/markah)

**PART B / BAHAGIAN B**

4. [a] A material's engineering PhD student Rosaina who had conducted two-factor factorial experiment as a completely randomized design in her pursuit of the Kinetic model. From her experiment, Rosaina has constructed the ANOVA table (Table 2) for Kinetic model which is incomplete. Assume the significance level is 0.05. Answer the following questions:

*Pelajar PhD kejuruteraan bahan Rosaina yang telah menjalankan eksperimen dua faktor faktorial yang rawak pada keseluruhannya dalam usaha beliau mereka bentuk model kinetik. Daripada eksperimen beliau, Rosaina telah membina jadual ANOVA (Jadual 2) untuk model kinetik yang tidak lengkap. Andaikan aras signifikan adalah 0.05. Jawab soalan-soalan berikut:*

**Table 2 - ANOVA table for Kinetic model**

**Jadual 2 - Jadual ANOVA untuk model kinetik**

Source	Sum of Square (SS)	Degree of Freedom (DF)	Mean Square (MS)	F- Value
Pressure(A)	350.00	2		
Temperature ( B)	300.00		150	
Interaction	200.00		50	
Error	150.00	18		
Total	1000.00			

- (i) Based on the above given data construct the table and complete the empty cells.

*Berdasarkan data yang diberikan, bina jadual dan lengkapkan sel-sel kosong.*

- (ii) Calculate the levels of factor Temperature (B) did she use in the experiment?

*Kira tahap faktor Suhu (B) digunakan dalam eksperimen?*

- (iii) Calculate the degrees of freedom are associated with the interaction?

*Kirakan darjah kebebasan yang berkaitan dengan interaksi?*

- (iv) Determine the error mean square?

*Tentukan ralat kuasa dua min?*

- (v) Determine the mean square for factor Pressure (A)?

*Tentukan min kuasa dua untuk faktor Tekanan (A)?*

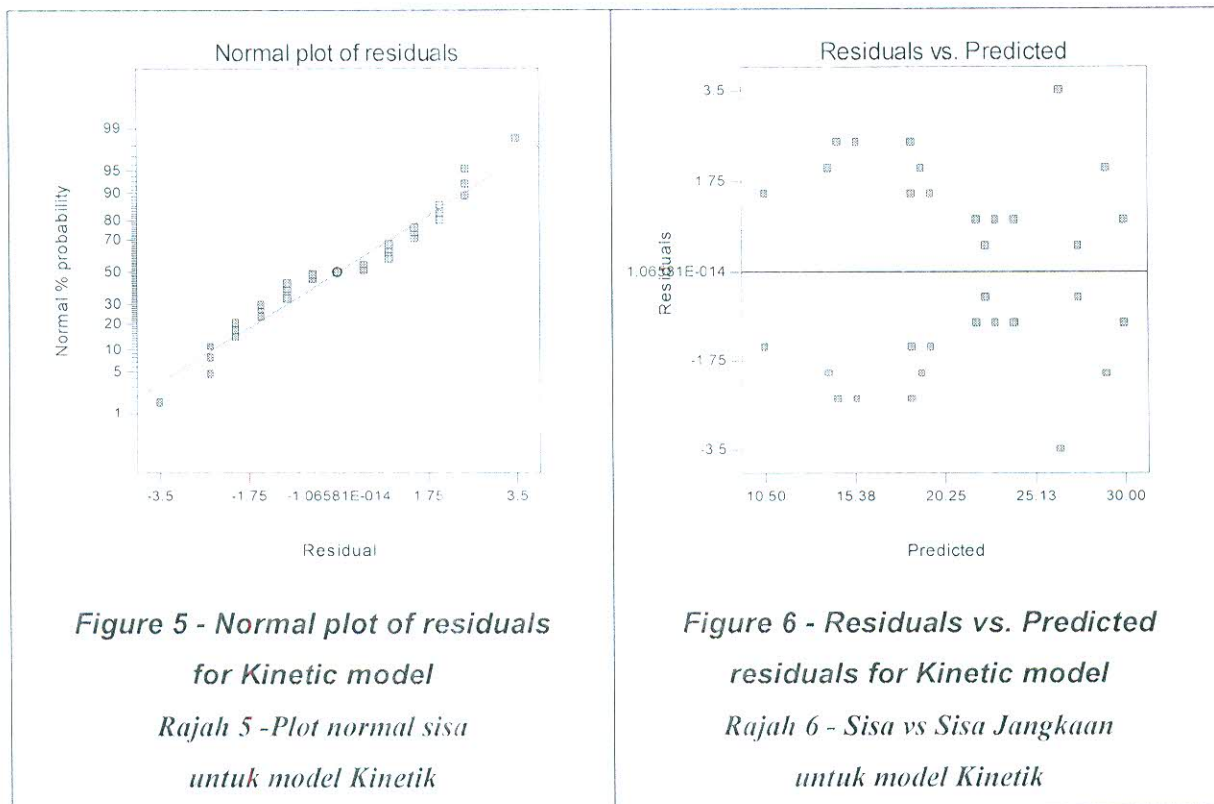
- (vi) Determine the replicates of the experiment were conducted?

*Tentukan replikasi eksperimen yang telah dijalankan?*

(50 marks/markah)

- [b] From Rosaina's experiment, 4[a], Rosaina is required to submit a Kinetic model report to her supervisor. Rosaina's supervisor requested her to provide an accurate summary of the overall new finding using the ANOVA from 4[a], Figure 5 and Figure 6.

*Dari eksperimen 4[a], Rosaina perlu menghantar laporan model kinetik kepada penyeliaanya. Penyelia Rosaina meminta beliau untuk menyediakan laporan ringkasan yang tepat untuk keseluruhan penemuan baru dengan menggunakan ANOVA daripada 4[a] Rajah 5 dan Rajah 6.*



- (i) What could be the Rosaina's conclusions about interaction and the two main effects?

*Apakah kesimpulan anda tentang interaksi dan dua kesan utama?*

- (ii) How will Rosaina find the estimation of the standard deviation of her response variable?

*Bagaimana Rosaina akan menganggarkan sisihan piawai pembolehubah tindakbalas.*

- (iii) How will Rosaina analyze the residuals from the experiment results of Figure 5 and Figure 6?

*Bagaimana Rosaina akan menganalisis sisa daripada keputusan eksperimen Rajah 5 dan Rajah 6?*

(50 marks/markah)

5. [a] The kinetic process is currently run at a temperature of 200°C and a reaction time of 200 minutes. A process engineer decides to run a  $2^2$  full factorial experiment with factor levels as follows:

*Proses kinetik kini dikendalikan pada suhu 200°C dan tindakbalas masa 200 minit. Seorang jurutera proses memutuskan untuk menjalankan  $2^2$  faktorial penuh dengan tahap faktor seperti berikut:*

Factor	Low	Center	High
Temperature ( $X_1$ ) in °C	170	200	230
Reaction Time ( $X_2$ ) in minutes	150	200	250

Five repeated runs at the center levels were conducted to assess lack of fit.

*Lima larian berulang di peringkat pusat telah dijalankan untuk menilai kekurangan kesesuaian.*

The experimental results were:

*Keputusan eksperimen ialah:*

$x_1$	$x_2$	$X_1$	$X_2$	Y (= yield)
-1	-1	170	150	32.79
+1	-1	230	150	24.07
-1	+1	170	250	48.94
+1	+1	230	250	52.49
0	0	200	200	38.89
0	0	200	200	48.29
0	0	200	200	29.68
0	0	200	200	46.50
0	0	200	200	44.15

The corresponding ANOVA table for a first-order polynomial model is

*Sepadanan jadual ANOVA untuk model polinomial tertib pertama adalah*

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	PROB>F
MODEL	503.3035	2	251.6517	4.7972	0.0687
CURVATURE	8.2733	1	8.2733	0.1577	0.7077
RESIDUAL	262.2893	5	52.4579		
LACK OF FIT	37.6382	1	37.6382	0.6702	0.4590
PURE ERROR	224.6511	4	56.1628		
COR TOTAL	773.8660	8			

and the given resulting model (in the coded variables) is

*dan model yang diberikan akibat (dalam pembolehubah berkod) adalah*

$$\hat{Y} = 40.644 - 1.2925x_1 + 11.14x_2$$

- (i) State the orthogonally coded factors for  $x_1$  and  $x_2$ ?

*Nyatakan faktor-faktor yang berserenjang antara berkode untuk  $x_1$  dan  $x_2$ ?*

- (ii) If given  $R^2 = 0.6504$  for diagnostic checks, what can you conclude on the conformance of first-order polynomial equation from regressive derivation?

*Jika diberi  $R^2 = 0.6504$  untuk pemeriksaan diagnostik, apakah kesimpulan yang anda boleh buat mengenai kesesuaian untuk persamaan polinomial peringkat pertama terbitan regresif?*

- (iii) Is the regression first order model is significant? Explain.

*Adakah model regresi tertib pertama adalah signifikan? Terangkan.*

- (iv) Develop the uncoded model from the coded model.

*Bangunkan model tidak berkode daripada model berkode.*

- (v) Which factor is the most influential factor? State your reason.

*Faktor yang manakah merupakan faktor yang paling berpengaruh? Berikan alasan anda.*

- (vi) The process engineer decides to use temperature at 220°C and a reaction time of 210 minutes as his new choice factors. Do you think the engineer made wise decision to get optimum results based on 2<sup>2</sup> full factorial experiments? Explain why?

*Jurutera proses memutuskan untuk menggunakan suhu pada 220°C dan masa tindakbalas 210 minit sebagai faktor pilihan barunya. Adakah anda fikir jurutera telah membuat keputusan bijak untuk mendapatkan keputusan yang optimum berdasarkan 2<sup>2</sup> ujikaji faktorial penuh? Terangkan mengapa?*

(50 marks/markah)

- [b] Your supervisor assigned you a mini project to be accomplished as your assignment for mineral resource engineering course. According to your supervisor, he suspects that the drilling speed and the feed rate of the material are the most important factors for thrust force developed by a drill. Your supervisor has selected four level feed rates and uses a high and low drill speed to represent the extreme operating conditions. You have obtained the following experimental results and employed Design Expert to analyze your results.

*Penyelia anda memberikan anda satu projek mini untuk dijayakan sebagai tugas untuk kursus kejuruteraan sumber mineral. Menurut penyelia anda, dia mengesyaki bahawa kelajuan penggerudian dan kadar suapan bahan adalah faktor yang paling penting untuk daya tujah yang dibina oleh gerudi. Penyelia anda telah memilih empat kadar tahap suapan dan menggunakan kelajuan gerudi yang berkadar tinggi dan rendah untuk mewakili keadaan operasi yang melampau. Anda telah mendapat keputusan eksperimen berikut dan menggunakan Design Expert untuk menganalisis keputusan anda.*

**Table 3 - Experimental data for Force response with Drill Speed (A) and Feed Rate (B) as factors**  
**Jadual 3 - Data uji kaji untuk respon daya tujah dengan kelajuan penggerudian (A) dan kadar suapan bahan (B) sebagai faktor**

(A) Drill Speed	Feed Rate (B)			
	0.015	0.030	0.045	0.060
125	2.70	2.45	2.60	2.75
	2.78	2.49	2.72	2.86
200	2.83	2.85	2.86	2.94
	2.86	2.80	2.87	2.88

**Table 4 - Design Expert Output for the Force response with Drill Speed (A) and Feed Rate (B) as factors**  
**Jadual 4 - Design Expert untuk respon daya tujah dengan kelajuan penggerudian (A) dan kadar suapan bahan (B) sebagai faktor**

Source	Sum of Squares	DF	Mean Square	F Value	Prob > F	significant
Model	0.28	7	0.040	15.53	0.0005	significant
A	0.15	1	0.15	57.01	< 0.0001	
B	0.092	3	0.031	11.86	0.0026	
AB	0.042	3	0.014	5.37	0.0256	
Residual	0.021	8	2.600E-003			
Lack of Fit	0.000	0				
Pure Error	0.021	8	2.600E-003			
Cor Total	0.30	15				

The Model F-value of 15.53 implies the model is significant.  
There is only a 0.05% chance that a "Model F-Value" this large could occur due to noise.  
Values of "Prob > F" less than 0.0500 indicate model terms are significant.

Std. Dev.	0.081	R-Squared	0.7417
Mean	2.77	Adj R-Squared	0.6772
C.V.	2.92	Pred R-Squared	0.5517
PRESS	0.14	Adeq Precision	9.269

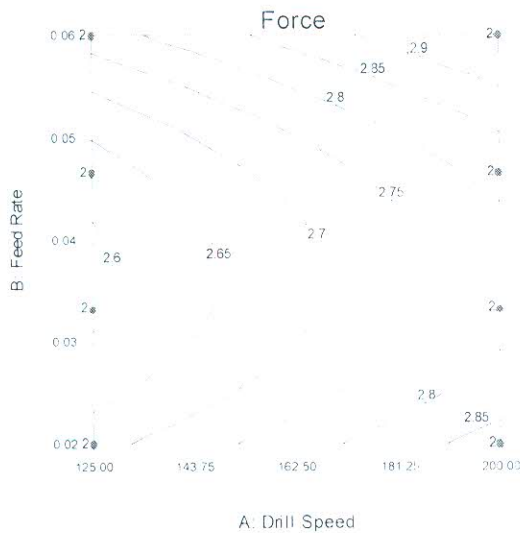
Factor	Coefficient Estimate	DF	Standard Error	95% CI Low	95% CI High	VIF
Intercept	2.69	1	0.032	2.62	2.76	
A-Drill Speed	0.096	1	0.020	0.052	0.14	1.00
B-Feed Rate	0.047	1	0.027	-0.013	0.11	1.00
AB	0.13	1	0.045	0.036	0.23	1.00

**Final Equation in Terms of Coded Factors:**

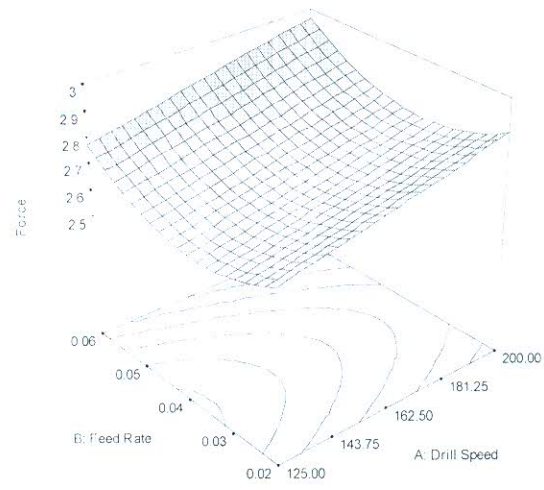
$$\text{Force} = +2.69 + 0.096 * A + 0.047 * B + 0.13 * AB$$

**Final Equation in Terms of Actual Factors:**

$$\text{Force} = +2.48917 + 3.06667E-003 * \text{Drill Speed} - 15.76667 * \text{Feed Rate} + 266.66667 * \text{Drill Speed} * \text{Feed Rate}$$



(a)



(b)

**Figures 7 - 2D (a) and 3D (b) contour Plot for Force response with Drill Speed (A) and Feed Rate (B) as factors**

*Rajah 7 - 2D (a) dan 3D (b) Plot kontur respon daya tujah dengan kelajuan penggerudian (A) dan kadar suapan bahan (B) sebagai faktor*

- (i) Identify the significant terms for the Force response?

*Kenal pasti syarat-syarat signifikan untuk respon daya tujah ini?*

- (ii) Is your supervisors assumption correct? Justify your answer.

*Adakah andaian penyelia anda betul? Jelaskan jawapan anda.*

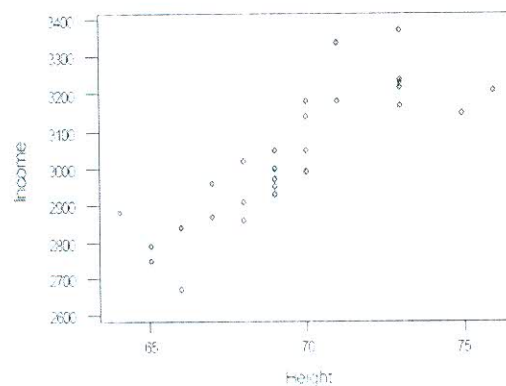
- (iii) Write a summary of analysis to conclude your project using ANOVA results, 2D (a) and 3D (b) contour plot and overall results of regression on coded equation.

*Tulis ringkasan analisis untuk membuat kesimpulan projek anda menggunakan keputusan ANOVA, 2D (a) dan 3D (b) plot kontur dan keputusan keseluruhan regresi persamaan berkod.*

(50 marks/markah)

6. [a] This Minitab output below shows the result of regression for monthly incomes in ringgit against physical heights in inches for a sample of male PPKBSM in 2008 in Malaysia as a correlation. These are the data provided for the analysis.

*Output Minitab di bawah ini menunjukkan keputusan regresif pendapatan bulanan ringgit berbanding ketinggian fizikal dalam inci untuk sampel korelasi PPKBSM lelaki pada tahun 2008 di Malaysia. Ini adalah data yang disediakan untuk analisis.*



**Figure 8 - Data plot Income vs Height**

*Rajah8 - Data plot Pendapatan lawan Ketinggian*

**Table 5 - Regression Analysis: INCOME vs. HEIGHT**

*Jadual 5 - Analisis Regresi: PENDAPATAN lawan KETINGGIAN*

The regression equation is					
INCOME = -451.12 + 50.18 HEIGHT					
Predictor	Coef	SE Coef	T	P	
Constant	-451.115	415.518	-1.08	0.290	
Height	50.1788	6.0079	8.35	0.000	
S = 95.3510    R-Sq = 71.4%    R-Sq(adj) = 70.3%					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	1	647608.1	647608.10	69.76	0.000
Residual	28	259938.4	9091.81		
Total	29	907456.5	31294.70		

You may use the response "Not possible to determine based on the information given" if you believe that the information cannot be determined from the results. Based on the given table Regression Analysis: INCOME vs. HEIGHT and figure Data plot Income vs Height above, answer the following questions:

*Anda boleh menggunakan respons "Tidak mungkin untuk menentukan berdasarkan maklumat yang diberikan" jika anda percaya bahawa maklumat tidak dapat ditentukan daripada keputusan yang diberikan. Berdasarkan jadual Analisis Regresi: PENDAPATAN lawan KETINGGIAN dan rajah Data plot Pendapatan lawan Ketinggian di atas, jawab soalan berikut:*

- (i) Find the value of  $s_e$  the standard error of the regression?

*Cari nilai  $s_e$  ralat piawai regresi?*

- (ii) Find the standard deviation of INCOME? (Just show the computation)

*Cari sisihan piawai PENDAPATAN? (Hanya tunjuk pengiraan)*

- (iii) Calculate the number of data points were used in this regression?

*Kira bilangan titik data yang telah digunakan dalam regresi ini?*

- (iv) What is the average INCOME in this data set?

*Apakah PENDAPATAN purata dalam set data ini?*

- (v) Find the correlation coefficient  $r$  between INCOME and HEIGHT. State whether it is positive or negative and justify your answer?

*Cari  $r$  pekali korelasi antara PENDAPATAN dan KETINGGIAN. Nyatakan sama ada positif atau negatif dan beri justifikasi untuk jawapan anda?*

(50 marks/markah)

...21/-

- [b] Refer to monthly incomes in ringgit against heights in inches for a sample of male PPKBSM in 2008 in Malaysia and the table of Regression Analysis: INCOME vs. HEIGHT and figure Data plot Income vs Height above, answer the following questions.

*Merujuk kepada pendapatan bulanan ringgit berbanding ketinggian dalam inci untuk sampel PPKBSM lelaki pada tahun 2008 di Malaysia dan jadual Analisis Regresi: PENDAPATAN vs HEIGHT dan angka Data plot Pendapatan vs Ketinggian di atas, jawab soalan berikut.*

- (i) Does this estimated regression provide convincing evidence of a statistical relationship between INCOME and HEIGHT? Illustrate your answer.

*Adakah regresi yang dianggarkan ini menyediakan bukti yang meyakinkan bahawa hubungan statistik antara PENDAPATAN dan KETINGGIAN? Jelaskan jawapan anda.*

- (ii) The slope of the regression line is +50.1788. How would you interpret this value?

*Kecerunan garis regresi adalah +50.1788. Bagaimana anda mentafsir nilai ini?*

- (iii) This study was redone in 2012 with a more general data set by a lecturer from Social Sciences School from Australia. According to their study, every five centimeters of height are worth about Australian dollar \$950 per year to the average man. Since they were done at different times and in different countries, are the results of the two studies similar? Give your reason. Here are some facts you need: (1) There are 12 months in a year. (2) There are 2.54 centimeters in an inch. (3) The consumer price index went from 100 to 215 from 2008 to 2012 in Australia (4) One Australian dollar is worth about 2.91 Malaysian Ringgit.

*Kajian ini dilakukan semula pada 2012 dengan data yang lebih umum yang ditetapkan oleh pensyarah daripada Pusat Sains Sosial dari Australia. Menurut kajian mereka, setiap lima sentimeter ketinggian adalah bernilai kira-kira dolar Australia \$ 950 setiap tahun untuk lelaki purata. Oleh kerana mereka telah melakukan kajian pada masa yang berlainan dan di negara yang berbeza, adakah hasil daripada kedua-dua kajian adalah sama? Berikan alasan anda. Berikut adalah beberapa fakta yang anda perlu tahu: (1) Dalam setahun ada 12 bulan. (2) 2.54 sentimeter bersamaan dengan 1 inci. (3) Indeks harga pengguna naik 100 kepada 215 dalam 2008 hingga 2012 tahun di Australia (4) Satu dolar Australia bernilai kira-kira 2.91 Ringgit Malaysia.*

(50 marks/markah)