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Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2014/2015**

COURSE NAME : DESIGN OF EXPERIMENT  
COURSE CODE : BWB 31803  
PROGRAMME : 3 BWB  
EXAMINATION DATE : JUNE/JULY 2015  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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- Q1** A chemist wishes to test the effects of four chemical agents on the strength of particular type of cloth. He believed that different bolts (gulung kain) might have an effect on the strength of the cloth. He planned to use 3 bolts in the experiments.

**Table Q1:** The effects of four chemical agents on the strength of particular type of cloth

Chemical Agents	Bolts			Total
	1	2	3	
1	71	72	72	215
2	68	67	68	203
3	74	75	78	227
4	67	67	68	135
Total	280	214	286	780

- (a) What is the most appropriate design for the above problem. (2 marks)
- (b) How the above experiments were performed so that it is appropriate for the design chosen in (a)? (2 marks)
- (c) List what are the experimental units and the treatments in this design. (2 marks)
- (d) Briefly explain what will you do to prevent the effect of the testing machine used to measure the strength of the cloth, from affecting the results. (4 marks)
- (e) Based on the data, would the chemist manage to conclude his design objectives? Justify your answer. (10 marks)

- Q2** An experiment is conducted to investigate the lives of three brands of batteries. It is suspected that the lives (in weeks) of the three brands are different. Four batteries of each brand are tested with the following results.

**Table Q2:** Investigate the lives of three brands of batteries

Weeks of life	Brands			Total
	1	2	3	
1	81	76	108	265
2	90	80	100	270
3	82	75	96	253
4	96	84	98	278
Total	349	315	402	780

- (a) What is the most appropriate design for the above problem?  
(2 marks)
- (b) How the above experiments were performed.  
( 2 marks)
- (c) Name the category the factor under study belongs to.  
(1 mark)
- (d) Test the researcher's hypothesis. Analyse the data and draw conclusion.  
(10 marks)
- (e) Do you agree with the researcher's decision to select Battery of Brand 3 for use? Justify your answer.  
(7 marks)

**Q3** Four types of car rear mirrors are being studied to determine their glaring effect. The researchers who conducted this study believed that there were differential effects of the four types of mirrors. Four drivers were involved in this experiment. To carry out the experiment, each drivers was to sit in front of each types of mirror consecutively at a reasonable time intervals. A beam of light from a car, 30 feet away behind him was shone to the mirror. Each driver was exposed to three types of mirror. The following data were obtained. Higher score indicates lower glaring effect.

**Table Q3:** Determine their glaring effect of the four types of mirrors

Types of Mirror	Drivers				Total
	1	2	3	4	
1	A = 73	A = 74	B = 76	A = 71	285
2	C = 73	B = 75	C = 68	B = 72	288
3	D = 75	C = 75	D = 78	D = 75	297
Total	221	224	207	218	780

- (a) What is the most appropriate design for the above problem? (2 marks)
- (b) State what is the experimental unit. (1 mark)
- (c) Briefly explain how treatments are assigned to the experimental units. (3 marks)
- (d) Would he manage to conduct his design objective? Justify your answer. (14 marks)

**Q4** An engineer is designing a battery for use in a device that will be subjected to some extreme variations in temperature. He is interested in the effects of three types of plate materials and three temperature levels on the life of a particular battery. For batteries are tested at each combination of plate material and temperature and all 36 test are run in random order. The following data is obtained as in Table Q4

**Table Q4:** Effects of three types of plate materials on the life of a particular battery

Material type	Tempreture						Total
	15F		70F		125F		
1	130	155	34	40	20	70	196
	74	180	80	75	82	58	116
2	150	188	136	122	25	70	180
	159	126	106	115	58	45	132
3	138	110	174	120	96	104	155
	168	160	150	139	82	60	127

- (a) How do you differentiate among different types of design? Discuss the difference between 2 factor factorial design and Randomized Complete Block Design. (4 marks)
- (b) State the simple rules for constructing test statistics for testing any hypothesis. (2 marks)
- (c) Based on these data, would he manage to conduct his design? (14 marks)

- Q5** Consider an experiment to investigate the effect of 4 diets on milk production. There are 4 cows. Each lactation period the cows received a different diet. Assume there is a washout period. So previous diet does not affect future results.

**Table Q5:** Effect of 4 diets on milk production

Period	Cows			
	1	2	3	4
1	A=38	B=39	C=45	D=41
2	B=32	C=37	D=38	A=30
3	C=35	D=36	A=37	B=32
4	D=33	A=30	B=35	C=33

- (a) What is the most appropriate design for the above problem? (1 marks)
- (b) Write the appropriate properties about the design above. (2 marks)
- (c) Write the model and assumptions given the design above (3 marks)
- (d) Based on these data, would he manage to conduct his design. Justify your answer. (14 marks)

**-END OF QUESTION-**