**UNIVERSITY OF SWAZILAND**

**FACULTY OF COMMERCE**

**DEPARTMENT OF BUSINESS ADMINISTRATION**

**FINAL EXAMINATION PAPER; IDE STUDENTS**

MAY **2016**

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TITLE OF PAPER : MANAGEMENT SCIENCE11

COURSE CODE : BA407

TIME ALLOCATED : THREE [3] HOURS

TOTAL MARKS : 100 MARKS

INSTRUCTIONS

1. TOTAL NUMBER OF QUESTIONS IN THIS PAPER IS 4
2. THE PAPER CONSISTS OF SECTION A AND SECTION B
3. ANSWER ALL QUESTIONS IN SECTION A WHICH ARE COMPULSORY AND TWO [2] QUESTIONS IN SECTION B.
4. THE MARKS ALLOCATED FOR A QUESTION/PART OF A QUESTION ARE INDICATED AT THE END OF EACH QUESTION/PART OF QUESTION.
5. NOTE: MAXIMUM MARKS WILL BE AWARDED FOR QUALITY, LAYOUT, ACCURACY, AND GOOD PRESENTATION OF WORK.

THIS PAPER MUST NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

SECTION A : ANSWER ALL QUESTIONS IN THIS SECTION

**QUESTION1.1**

4HIM, a security company, has a contract with UNISWA which is subject to renewal without going to tender provided there are no issues raised by UNISWA. 4HIM wishes to maximise efficiency at the different security points at Kwaluseni campus UNISWA staff houses. There are four security points and four security personnel identified for the required services to reap maximum efficiency. The table below shows efficiency levels that can be achieved if any of the security personnel is assigned to guard some point. You are requested to assist the Chief Security Officer with the said assignments. Please advise him on the most appropriate assignments that are likely to yield the optimum efficiency to 4HIM so it can stand a better chance of having its contract being renewed next year. If you look at Security Guard 3 in the table there will be 80 % efficiency when she or he is assigned to security point A, 100% to security point B, 90 % to security point C and 80% to security point D and so forth. An important assignment principle is that you give one assignment to one person at a time. What will be your recommendation in this instance? [15]

| SECURITY GUARD | SECURITY POINTS | | | |
|---|---|---|---|---|
| | A | B | C | D |
| 1 | 20 | 60 | 50 | 55 |
| 2 | 60 | 30 | 80 | 75 |
| 3 | 80 | 100 | 90 | 80 |
| 4 | 65 | 80 | 75 | 70 |

**QUESTION 1.2.**

| SUPPLY SOURCE | 1 | 2 | 3 | TOTAL |
|---|---|---|---|---|
| CAPACITY | 25 | 40 | 30 | 95 |
| DEMAND POINT | A | B | C | TOTAL |
| REQUIREMENTS | 30 | 30 | 35 | 95 |

Shipping costs from Source to Demand points are as follows:

| FROM/TO | A | B | C |
|---|---|---|---|
| 1 | E3 | E3 | E2 |
| 2 | E4 | E2 | E3 |
| 3 | E3 | E2 | E3 |

a. Determine the optimal transportation cost using the North West Corner Point method [10]
b. Will there be any benefits derived from using the Vogel's Approximation Method (VAM), instead of the North West Corner Point method?Explain your answer [10]

**QUESTION 1.3.**

Car wash has become big business in Swaziland and John actually opened an outlet recently at Matsapha. Now he wants to determine efficiency levels at the centre. The centre is able to clean cars at an average of 3 units per hour or about 1 unit every 20 minutes. Customers who need carwash service arrive at the centre at an average of 2 per hour. If all the conditions of the single channel queuing model are met, calculate values of the following operating characteristics.

i. The average number of cars in the system(number in line plus number being served) [2]
ii. Average time the customer spends in the system( time spent in line and time spent being served) [2]
iii. Average number of cars in the queue [2]
iv. Average time a customer spends waiting in the queue [2]
v. The utilisation factor for the system(probability that the service facility is busy) [1]
vi. The per cent idle time(probability that there is no one in the system) [1]

**[TOTAL MARKS 50]**

**Section B. Choose 2 questions of your choice from this section. Each question carries 25 marks .**

## QUESTION 2.

Study the following data for constructing a new Government hospital to release pressure from RFM which is overcrowded. Data for the Manzini Government Hospital is summarised in the table below.

| Activities | Immediate Predecessor | Activity Duration (weeks) |
|---|---|---|
| **Organising and site preparation** | | |
| A: Select administrative staff | - | 12 |
| B: Site selection and survey | - | 9 |
| C: Select medical equipment | A | 10 |
| D: Prepare final construction plans | B | 10 |
| E: Bring utilities to site | B | 24 |
| F: Interview applicants for nursing and support staff | A | 10 |
| | | |
| **Physical facilities and infrastructure** | | |
| G: Purchase and deliver equipment | C | 35 |
| H: Construct hospital | D | 40 |
| I: Develop information system | A | 15 |
| J: Install medical equipment | E,G,H | 4 |
| K. Train nurses and support staff | F,I,J | 6 |

2.1 Draw the network diagram for the hospital project [8]

2.2 Determine the earliest start, earliest finish, latest start and latest finish times for activity [10]

2.3 What is the project's critical path? [4]

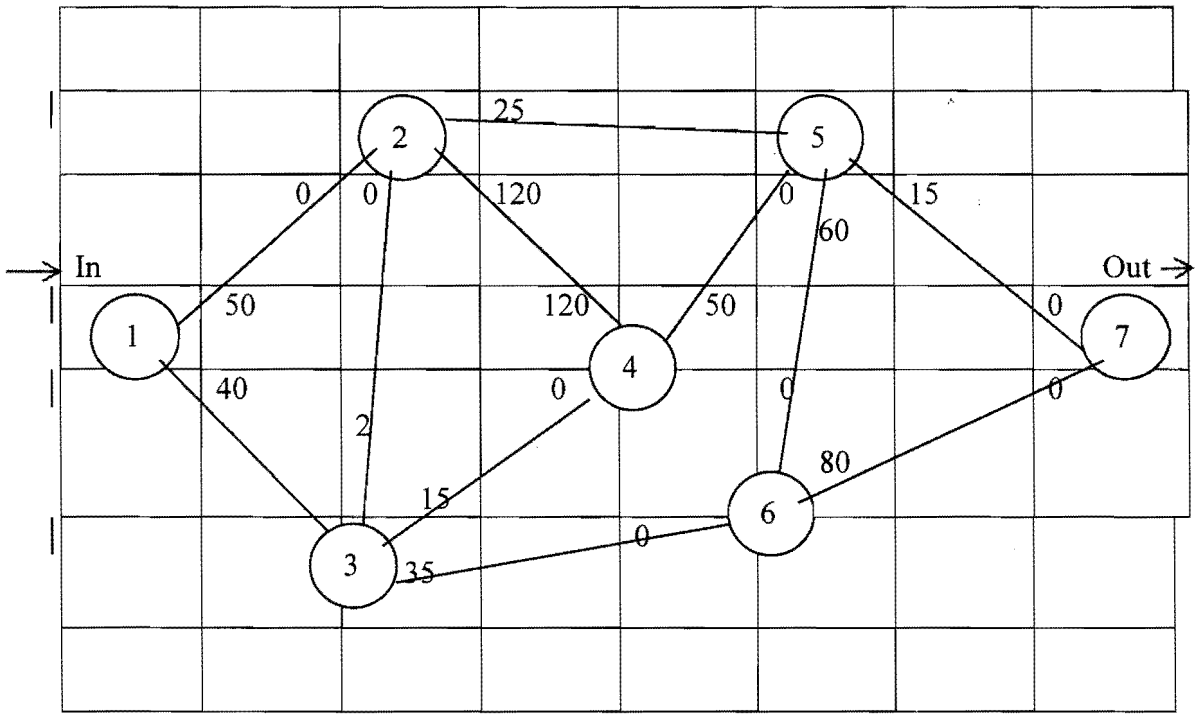
2.4 How much time is needed to finish the project? [3]

**[TOTAL 25 MARKS]**

**QUESTION 3.1.**

The Swaziland tourism market is famous about its Mandenga -cultural village in Ezulwini. The unique village which is in the midst of hilly forests has limited capacity because it takes about 20 visitors at a time. As a result of this authorities must restrict the flow of tourists through the village. Daily capacity, especially during public holidays is very limited, and tourists demand exceeds the present limit. Given flow patterns and capacitated tranches shown in the network table below what is the maximum number of tourists to go through the village without causing any problems. [15]

During the August 2016 SADC conference to be hosted in Swaziland Government directed that 100 people per hour will be reasonable. What advise will you give to Government? [3].



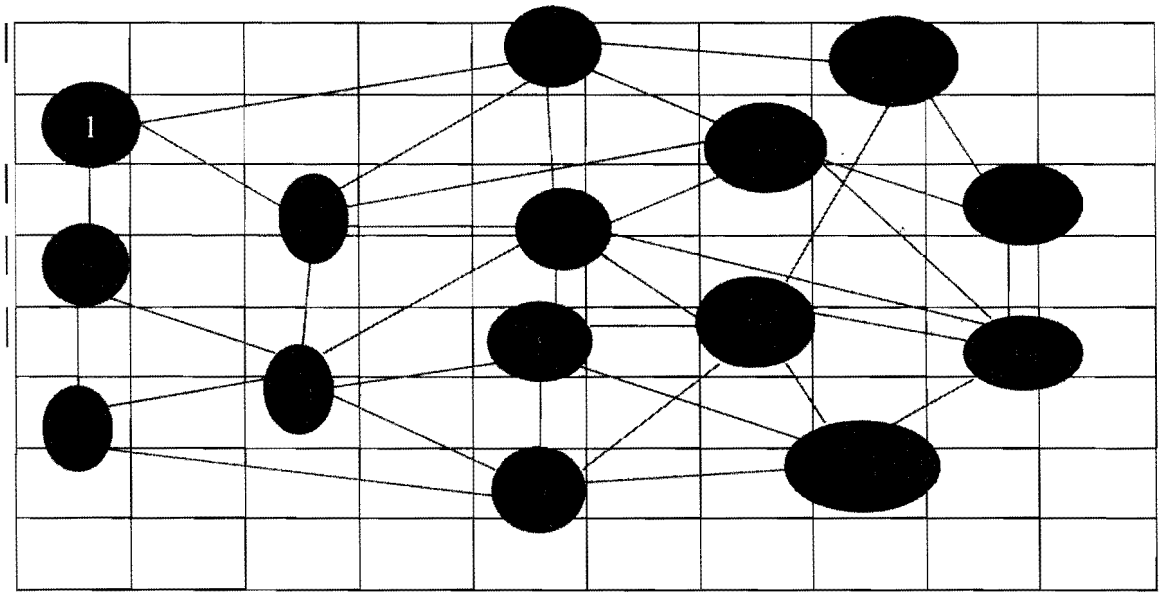

QUESTION 3.2.

Briefly explain three psychological effects of waiting lines and how the effects can be controlled? [7]

**[TOTAL 25 MARKS]**

## QUESTION 4.1

The Matsapha Municipality purchased land for a new state park, and park planners identified the ideal locations for lodge, cabins, picnic groves, boat dock, and scenic points of interest. The locations are represented by the nodes of the following network. The arcs of the networks represent possible road connections in the park. Distances between locations are shown separately in the table below the network. If the park designers want to minimise the total road kilometres that must be constructed in the park and still permit access to all facilities(nodes), which road connections should be constructed? [20]




| From | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | 2 | 5 | 6 | 3 | 4 | 4 | 9 | 5 | 7 | 8 | 9 | 6 | 7 | 7 | 11 | 12 | 8 | 10 | 11 | 9 | 10 | 13 | 10 | 13 |
| Distance | 8 | 6 | 2 | 1 | 4 | 9 | 3 | 3 | 4 | 6 | 2 | 5 | 11 | 3 | 8 | 12 | 1 | 2 | 4 | 5 | 3 | 4 | 3 | 6 |

| From | 10 | 10 | 10 | 11 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|
| To | 12 | 13 | 14 | 14 | 15 | 15 | 14 | 15 |
| Distance | 6 | 7 | 5 | 6 | 7 | 3 | 4 | 2 |

## QUESTION 4.2

Why is the shortest route technique a weaker technique than the maximum flow and minimum flow techniques? **[5 ]**

**[TOTAL 25 MARKS]**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | 06 | 50 | 88 | 53 | 30 | 10 | 47 | 99 | 37 | 66 | 91 | 35 | 32 | 00 | 84 | 57 | 07 |
| 37 | 63 | 28 | 02 | 74 | 35 | 24 | 03 | 29 | 60 | 74 | 85 | 90 | 73 | 59 | 55 | 17 | 60 |
| 82 | 57 | 68 | 28 | 05 | 94 | 03 | 11 | 27 | 79 | 90 | 87 | 92 | 41 | 09 | 25 | 36 | 77 |
| 69 | 02 | 36 | 49 | 71 | 99 | 32 | 10 | 75 | 21 | 95 | 90 | 94 | 38 | 97 | 71 | 72 | 49 |
| 98 | 94 | 90 | 36 | 06 | 78 | 23 | 67 | 89 | 85 | 29 | 21 | 25 | 73 | 69 | 34 | 85 | 76 |
| 96 | 52 | 62 | 87 | 49 | 56 | 59 | 23 | 78 | 71 | 72 | 90 | 57 | 01 | 98 | 57 | 31 | 95 |
| 33 | 69 | 27 | 21 | 11 | 60 | 95 | 89 | 68 | 48 | 17 | 89 | 34 | 09 | 93 | 50 | 44 | 51 |
| 50 | 33 | 50 | 95 | 13 | 44 | 34 | 62 | 64 | 39 | 55 | 29 | 30 | 64 | 49 | 44 | 30 | 16 |
| 88 | 32 | 18 | 50 | 62 | 57 | 34 | 56 | 62 | 31 | 15 | 40 | 90 | 34 | 51 | 95 | 26 | 14 |
| 90 | 30 | 36 | 24 | 69 | 82 | 51 | 74 | 30 | 35 | 36 | 85 | 01 | 55 | 92 | 64 | 09 | 85 |
| 50 | 48 | 61 | 18 | 85 | 23 | 08 | 54 | 17 | 12 | 80 | 69 | 24 | 84 | 92 | 16 | 49 | 59 |
| 27 | 88 | 21 | 62 | 69 | 64 | 48 | 31 | 12 | 73 | 02 | 68 | 00 | 16 | 16 | 46 | 13 | 85 |
| 45 | 14 | 46 | 32 | 13 | 49 | 66 | 62 | 74 | 41 | 86 | 98 | 92 | 98 | 84 | 54 | 33 | 40 |
| 81 | 02 | 01 | 78 | 82 | 74 | 97 | 37 | 45 | 31 | 94 | 99 | 42 | 49 | 27 | 64 | 89 | 42 |
| 66 | 83 | 14 | 74 | 27 | 76 | 03 | 33 | 11 | 97 | 59 | 81 | 72 | 00 | 64 | 61 | 13 | 52 |
| 74 | 05 | 81 | 82 | 93 | 09 | 96 | 33 | 52 | 78 | 13 | 06 | 28 | 30 | 94 | 23 | 37 | 39 |
| 30 | 34 | 87 | 01 | 74 | 11 | 46 | 82 | 59 | 94 | 25 | 34 | 32 | 23 | 17 | 01 | 58 | 73 |
| 59 | 55 | 72 | 33 | 62 | 13 | 74 | 68 | 22 | 44 | 42 | 09 | 32 | 46 | 71 | 79 | 45 | 89 |
| 67 | 09 | 80 | 98 | 99 | 25 | 77 | 50 | 03 | 32 | 36 | 63 | 65 | 75 | 94 | 19 | 95 | 88 |
| 60 | 77 | 46 | 63 | 71 | 69 | 44 | 22 | 03 | 85 | 14 | 48 | 69 | 13 | 30 | 50 | 33 | 24 |
| 60 | 08 | 19 | 29 | 36 | 72 | 30 | 27 | 50 | 64 | 85 | 72 | 75 | 29 | 87 | 05 | 75 | 01 |
| 80 | 45 | 86 | 99 | 02 | 34 | 87 | 08 | 86 | 84 | 49 | 76 | 24 | 08 | 01 | 86 | 29 | 11 |
| 53 | 84 | 49 | 63 | 26 | 65 | 72 | 84 | 85 | 63 | 26 | 02 | 75 | 26 | 92 | 62 | 40 | 67 |
| 69 | 84 | 12 | 94 | 51 | 36 | 17 | 02 | 15 | 29 | 16 | 52 | 56 | 43 | 26 | 22 | 08 | 62 |
| 37 | 77 | 13 | 10 | 02 | 18 | 31 | 19 | 32 | 85 | 31 | 94 | 81 | 43 | 31 | 58 | 33 | 51 |

**Source:** Excerpted from *A Million Random Digits with 100,000 Normal Deviates* (New York: The Free Press, 1955), p. 7, with permission of the RAND Corporation.