



**FACULTY OF MANAGEMENT
SUPPLEMENTARY EXAMINATION**

DEPARTMENT OF QUALITY AND OPERATIONS MANAGEMENT

PROGRAMME : **BACCALALAUREUS TECHNOLOGIAE
OPERATIONS MANAGEMENT**

SUBJECT : **OPERATIONS MANAGEMENT
TECHNIQUES IV**

CODE : **BPI44A4**

DATE : **22nd July 2014**

DURATION : **3 HOURS**

TIME : **8h00**

TOTAL MARKS : **101** **WEIGHT** : **50**

EXAMINER(S) : **Dr P. KHOLOPANE**

(EXTERNAL) MODERATOR(S): **MR S FORE**

NUMBER OF PAGES : **5 PAGES**

INSTRUCTIONS TO CANDIDATES:

- Answer ALL questions.
- Please use Graph Papers provided for Question 5 and 6.
- Use figure provided to answer Question 8
- This is a closed book assessment.
- Leave margins and spaces between the questions.
- Show all your calculations.
- Unless otherwise indicated, express your answers correct to two (2) decimal places.
- Where appropriate, indicate the units of your answer. (e.g. Hour, R)
- Number your answers clearly.
- Write neatly and legibly
- NOTE: Marks will be awarded for theoretical knowledge, application of the theory and use of relevant examples.
- The general University of Johannesburg policies, procedures and rules pertaining to written assessments apply to this assessment.

Fore

OPERATIONS MANAGEMENT TECHNIQUES IV SUPPLEMENTARY EXAMS –
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QUESTION 1

[6]

Explain the following

1. Alternate optimal solution (2)
2. An infeasible region (2)
3. An unbounded problem (2)

QUESTION 2

[8]

Explain the Four Maximal-Flow Technique Steps in your own words

QUESTION 3

[8]

Debonair Pizza at the Chris Hani Mall in Vosloorus is considering baking a new Pizza product imported from Italy. The manager is therefore considering selling pizza at the store. She could bake and sell premade pizzas and heat them in an oven. The cost of an oven and freezer would be R27000. The frozen pizza cost R3.75 each to buy from a distributor and to prepare (including labour and a box). To be competitive with the local deliveries, the Manager believes she should sell the pizza for R8.95 a piece. The manager needs to write up a proposal to the Debonair's director of auxiliary services.

- a. Determine how many pizza would be sold to break even. (2)
- b. If the general store sells 20 pizzas per day, how many days would it take to break even. (2)
- c. The manager of the store anticipates that once the local pizza delivery service start losing business, they will react by cutting prices. If after a month(30 days) the manager has to lower the pizza to R7.95 to keep demand at 20 pizzas per day, as she expect, what will be the new break-even point be, and how long will it take the store to break even. (4)

Use formulae

$$TC = C_f + V_c, \quad Z = V_p - C_f - V_c, \quad V = C_f / p - C_v, \quad \text{Total Profit} = \text{Total revenue} - \text{Total cost}$$

QUESTION 4

[5]

Gauteng Province is intending to construct another train to cater for Vaal region called Vaal Train. There is a total of R200 million allocated for this construction. Two types of trains may be purchased and the Algoa. The Gia costs R25 million, while the Algoa costs R18 million. The Gia can carry 60,000 pounds of packages, while the Algoa can only carry 40,000 pounds of packages. The company needs at least ten new Trains. Formulate this as an integer programming problem to maximize the number of pounds that may be carried.

QUESTION 5

[11]

A company produces two products that are processed on two assembly lines. Assembly line 1 has 100 available hours, and assembly 2 has 42 available hours. Each product requires 10 hours of processing time on line 1, while on line 2 product 1 requires 7 hours and product 2 requires 3 hours. The profit for product 1 is R6 per unit, and the profit for product 2 is R4 per unit

- a. Formulate a linear programming model for this problem. (4)
- b. Solve the model by using graphical method and listing every corner points. 4+3=(7)



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QUESTION 6.

[18]

Daphney Malaka makes pottery by hand in her basement. She has 20 hours available each week to make bowls and vases. A bowl requires 3 hours of labour and vase 2 hours of labour. It requires 2 pounds of special clay to make a bowl and 5 pounds to produce a vase. She is able to acquire 35 pounds of clay per week. Daphney sells her bowls for R50 and her vase at R40. She wants to know how many of each item to make each week to maximise revenue.

- a. Formulate an integer programming model for this problem. (4)
- b. Draw graph. (4)
- c. Show the normal solution and the integer solution. (4)
- d. Follow x_1 to calculate profit using branch and bound method. (6)

QUESTION 7.

[15]

A manufacturing firm produces diesel engines in four cities- Germanton, Benoni, Heidelberg, and Sasol. The company is able to produce the following numbers of engines per month:

<i>Plant</i>	<i>Production</i>
1. Germiston	5
2. Benoni	25
3. Heidelberg	20
4. Sasol	25

Three trucking firms purchase the following numbers of engines for their plants in three cities:

<i>Firm:</i>	<i>Demand:</i>
A. Johannesburg	10
B. Pretoria	20
C. Rustenburg	15

The transportation costs per engine (in hundreds of dollars) from sources to destinations are shown in the following table. However, the Pretoria firm will not accept engines made in Benoni, and the Rustenburg firm will not accept engines from Sasol; therefore, those routes are prohibited:

From	To (cost, in R100s)		
	A	B	C
1	R 7	R 8	R 5
2	6	10	6
3	10	4	5
4	3	9	11

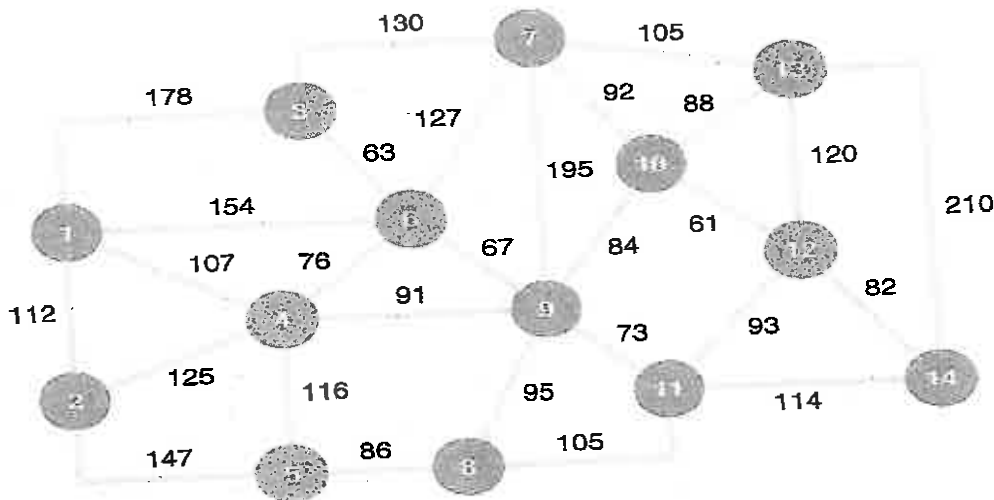
- a. Formulate this as a linear programming model (5)
- b. Determine the minimum costs (5)
- c. Use graphical illustration to show of transportation cost these trucks from city to city. (5)



QUESTION 8

[6]

University of Johannesburg have decided to restrict the side walk throughout the east side of its campus square to provide wheelchair access. However, upgrading sidewalks is a very expensive undertaking, so for the first phase of this project, university administrators at APK wants to make sure they connect all buildings with wheelchair access with the minimum number of refurbished sidewalk possible. The following is a network of the existing sidewalk of the east side of campus square, with the feet between each building shown on the branches.

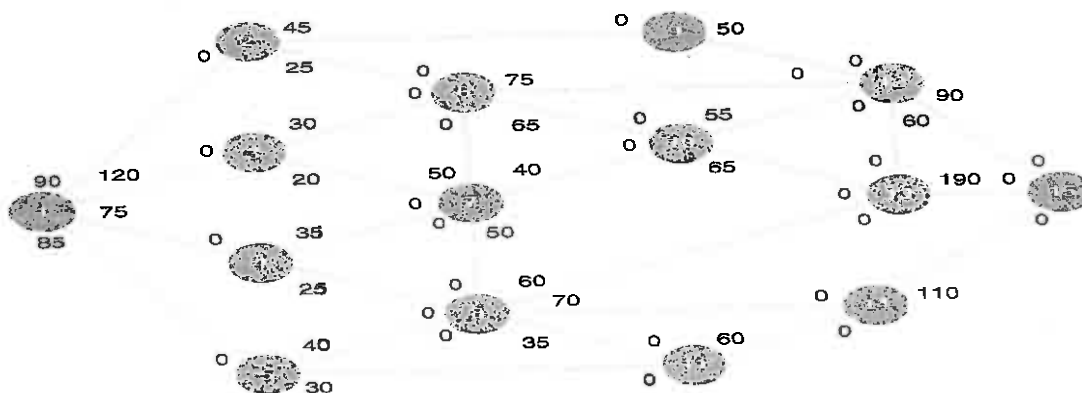


Determine the minimal spanning tree network that will connect all the buildings on campus with wheelchair access sidewalks and indicate the number of feet of sidewalk.

QUESTION 9

[24]

A manufacturing company produces different variations of a product at different work centers in its plant on a daily basis. The following is a network showing the various work centers in the plant, the daily capacities at each work center, and the flow of the partially complete product between work centers:



Node 1 represents the point where raw material enter the process, and node 15 is the packaging and distribution center. Determine the maximum number of units that can be completed each day and the number of units processed at each center. Follow the routes and indicated as discussed in class i.e. follow C

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- a. 1-2-6-10-12-13-15
- b. 1-2-6-12-13-15
- c. 1-2-9-12-15
- d. 1-3-6-10-12-15
- e. 1-3-7-10-13-15
- f. 1-4-7-10-13-15
- g. 1-4-7-6-10-13-15
- h. 1-4-7-6-12-15
- i. 1-4-8-13-15
- j. 1-5-8-13-15
- k. 1-5-8-14-15
- l. 1-5-11-14-15

