



PROGRAM : BACCALAUREUS TECHNOLOGIAE
CHEMICAL ENGINEERING

SUBJECT : **PRODUCTION ENGINEERING:
CHEMICAL INDUSTRY 4**

CODE : **PCI411**

DATE : SUMMER EXAMINATION 2014
6 NOVEMBER 2012

DURATION : (SESSION 1) 08:30 - 11:30

WEIGHT : 40 : 60

TOTAL MARKS : 98

FULL MARKS : 98

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MODERATOR : PROF MS ONYANGO 2335

NUMBER OF PAGES : PAGES

INSTRUCTIONS : ANSWER ALL QUESTIONS AND ENTER FINAL
ANSWERS ON BLACKBOARD (Bb) AS REQUIRED.
ANSWER FOLLOW-UP QUESTIONS ON BLACKBOARD
AS REQUIRED
HAND IN ATTENDANCE SLIP AND EXAM BOOKS
WITH ROUGH WORK

QUESTION 1

A company manufactures flotation cells and crushers of ore. The constraints for this integer LP problem are as follows:

$$3F + 2C \leq 12$$

$$5F + 6C \leq 30$$

0		6	7	0	0	
	VAR	F	C	S1	S2	VAL
8	F	1	0	0.75	-0.25	1.5
7	C	0	1	-0.625	0.375	3.75
	Z1	6	7	0.125	1.125	35.25
	C-Z1	0	0	-0.125	-1.125	

Also consider a tableau obtained during the solution of this problem shown above.

- 1.1. What is the objective function (z) of the problem? [2]
- 1.2. What are the values of the variables in the tableau? [4]
- 1.2. Does the tableau represent an optimum? [2]
- 1.3. Does the tableau represent a feasible solution? [2]
- 1.4. Following from the tableau given above, identify (on Bb) the constraints for one of the new tableaus to be set up. [4]

[14]

QUESTION 2

- 2.1. Which of the following are initial and which are optimum solutions for transportation and assignment problems: stepping stone, North West corner, Vogel's approximation method? (3)
- 2.2. How will you decide whether to use the rational crash and minimum cost solutions in Project Planning and Management? (4)
- 2.3. Identify the steps in obtaining the rational crash and minimum costs solutions in project planning and management. (8)
- 2.4. Trucks arrive at a loading server in hourly intervals according to the following table:

Time	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
No of trucks arriving	1	0	1	1	3	0	2	0	1	2

Calculate the average number of trucks arriving per hour, and then compare the Poisson model probability of a certain number of trucks arriving in an hour with the actual probability calculated from the data in the table. (12)

[27]

QUESTION 3

Month	June	July	Aug	Sep	Oct	
Orders	4	3	1	2	3	

The number of orders per month received by a factory manufacturing crushers are given in the table. The factory has a capacity to manufacture 2 crushers per month. Orders in excess of this are outsourced at an extra cost per crusher given on Bb in Rand.

Set up the required tables, sorting the order numbers from small to large, and use the random numbers between 0 and 99 on Bb to simulate the number of orders you could possibly expect for the next five months.

What would the decrease in the total extra outsourced cost be over this time period if the capacity of manufacturing were to be increased from 2 to 3 crushers per month?

[21]**QUESTION 4**

The accompanying table gives cash flows, for the past six years, of a business which the current owners aim to sell as a going concern for R8mil now (at the end of year 6).

Year	Cash Flow Rmil
1	0.51
2	0.561
3	0.61
4	0.63
5	0.71
6	1.06

- 4.1. Calculate the NPV in Rmil (as at year 0) of the project using the initial investment and interest rate given on Blackboard using yearly compounding. Also take into account of the R8mil salvage value. (9)
- 4.2. Can the owners claim that the project has been economic on the basis of the calculated NPV? Why? (2)
- 4.3. Current consensus is that there is a % chance (given on Bb) that the average interest rate will either go up to 12% for the next five years due to the crises in the Ukraine and Middle East, otherwise it will decrease slightly to 6% if the crises get resolved. If the interest rate goes up, R4mil could be earned with the business if it is run for five more years and then sold again. If it goes down leading to increased commercial activity, R10mil could be earned with the business. Using EMV as a measure, would you buy the business and run it for five additional years or would you keep your R8mil in the bank? (16)
- 4.4. As a potential buyer, you may wish to predict the cash flow for year 7 (i.e. the year after year 6 in the table). Do this using double moving average MA(3x2). (9)

[36]

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