UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACHELOR OF TECHNOLOGY *CHEMICAL ENGINEERING*
SUBJECT	:	**PRODUCTION ENGINEERING: CHEM INDUSTRY 4**
CODE	:	**PCI411**
DATE	:	SUPPLIMENTARY EXAMINATION DECEMBER 2019
DURATION	:	(SESSION 1) 08:30 - 11:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	142

EXAMINER(S)	:	MR P MJWANA
MODERATOR	:	DR. C BHONDAYI
NUMBER OF PAGES	:	3 PAGES

REQUIREMENTS	:	Use of scientific (non-programmable) calculator is permitted (only one per candidate)

HINTS AND INSTRUCTIONS TO CANDIDATE(S):

- **ATTEMPT ALL QUESTIONS**. Please answer each question to the best of your ability.
- Write your details (module name and code, ID number,student number etc.)on script(s).
- Number each question clearly; questions may be answered in any order.
- Make sure that you read each question carefully before attempting to answer the question.
- Transfer the answers accurately onto Blackboard (Bb).

QUESTION 1 **[Total: 24 Marks]**

1.1. the stock market can either increase (get the probability for this on Blackboard), stay the same or decrease. If the market is twice more likely to decrease than staying the same. If the expected profit for an increasing market is R100 000, and the loss if the marked decreases is R20 000, what is the EMV of your investment? No profit is made if the market stays the same. (10)

1.2. Which schedule would you use if your project budget were limited? (2)

1.3. In linear regression, what value would the correlation coefficient r_{xy} approach if there is a strong inverse linear relationship for the data? (2)

1.4.A small company manufactures heat exchangers. Orders received for the heat exchangers over the past five months are given in the table. Set up the required tables, sorting the order numbers from small to large, and use the random number between 0 and 99 on Blackboard to simulate the number of orders you could possibly expect for November. (10)

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

QUESTION 2 **[Total: 27 Marks]**

A small pump manufacturer produces three types of pump: Pump A, Pump B and Pump C. Each product must go through a wiring stage followed by an assembly stage. Pump A requires 4 hours of wiring and 2hours of assembly. Pump B requires 4 hours of wiring and 4 hours of assembly. Pump C requires 5 hours of wiring and 4 hours of assembly. All three pumps require testing of 1 hour each after assembly. The profits for Pump A, Pump B and Pump C are R2000, R2500 and R3000 respectively. Currently, each week there are 280 hours of wiring time available, 200 hours of assembly time and 55 hours of testing time.

2.1. Suggest the best number of A-type Pumps, B-type Pumps and C-type Pumps to produce a week using the Tableau method. (20)

2.2. Circle and annotate the following on the final table: the optimum profit, the number of pumps produced and the type and amount of resource left (if any). (5)

2.3. Is it necessary to do Integer Linear Programming? Explain. (2)

QUESTION 3 **[Total: 25 Marks]**

The current price of platinum is $1700 per ounce. An overseas company wants to invest in a platinum mine in South Africa with a capital investment of $100mil (obtained by a bank loan). Because of more awareness of the effects of global warming, there is a 40% chance that more electric cars will be manufactured in Europe, which will cause the platinum price to drop to $1000 per ounce, otherwise it will increase to $2000 per ounce for the next 15 years. Because of the increasing cost of labour in South Africa, the price of platinum should be at least $1500 per ounce for the mine to be viable. If it is not judged to be viable, then the company will not invest in the mine. The cost of capital/interest can be taken as 7% compounded yearly.

3.1. Draw a decision diagram for the above case. (10)

3.2. Use the decision analysis techniques taught in this course to determine whether the company should invest in the mine. (10)

3.3. What average yearly cash flow in $ would the mine need to generate to pay back the bank loan in 5 years? (5)

QUESTION 4 **[Total: 23 Marks]**

A new product needs to be developed on a limited budget. The activities, optimistic times (ta), most likely times (tm), pessimistic times (tb), predecessors and costs (in Thousands) are given in the table. Indirect costs are R4000 per week.

Activity	ta	tm	tb	Predecessor(s)	Normal	Crash Cost
A	5	6	7	-	20	30
B	2	3	10	-	16	24
C	1	8	9	A	18	25
D	3	4	5	A	10	12
E	5	6	7	B,C,D	14	19

4.1. Draw the AON diagram for the task at hand. (20)

4.2. What is the cost of the project? (3)

QUESTION 5 **[Total: 43 Marks]**

On average at, 18 trucks are expected to arrive every 3 hours at 2 unloading bays, manned by 1 person each. On average, it takes 1 hour to unload 4 trucks at one of the unloading bays. The chance of 4 trucks arriving in the next hour is 10%. The chances for 5, 6, 7, and 8 trucks are 20%, 40%, 20%, and 10% respectively.

5.1. At any given time, how many trucks will be in the system? Use queuing theory. (22)

5.2. Using Mont Carlo simulation, predict the number of trucks arriving for each of the following 8 hours using the following random numbers between 0 and 99:

58	91	70	86	48	65	28	92

(10)

5.3. Simulate what would happen if the truck fleet were increased by 23%. Will the unloading bays still be able to handle the increased number of trucks arriving? (8)

5.4. If you were using queuing theory, what would your answer for 5.3 be? (3)

END **[Total: 142 Marks]**