The Papua New Guinea University of Technology

Department of Mining Engineering

Fourth Year Mining and Mineral Process Engineering

SEMESTER 2 EXAMINATION

MN 412 – MINE MANAGEMENT

DATE: TUESDAY 27rd OCTOBER 2020

TIME: 12:50 PM

TIME ALLOWED 3 HOURS

INFORMATION FOR CANDIDATES

1. You have ten minutes to read this question paper. You must **not begin writing** during this period
2. **Answer all questions** and marks are indicated beside each question
3. **ALL** answers must be provided on the answer book provided. No other written materials will be accepted
4. Write your **NAME** and **STUDENT NUMBER** clearly on the answer book. This must be **done first**

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PART 1: HORT ANSWER QUESTIONS

QUESTION 1 [10 Marks]

As a graduate mining engineer and having not found a job, you plan to venture into small scale mining instead of wasting time seeking formal jobs. The first step in planning is thinking about Porter's Five Forces of competition.

(i) Briefly define each competitive force

(ii) Why is creating barriers to entry important in a competitive business environment?

PART 2: CALCULATIONS

QUESTION 1 [30 Marks]

A mining operation has two shovels and the company wants to maximise productivity in order to maximise profit. The factors (resources) required to maximise the productivity of the two shovels are: production capacity of each shovel (in tonnes), operating hours and mechanical availability of each shovel as shown in Table below.

Resource (Factor)	**Quantity of resources required for two shovels**		**Required quantity of each factor/resource**
	Shovel (1)	**Shovel (2)**	
Productivity (tonnes)	20	40	400
Shovel operating hours	5	2	40
Mechanical availability (hours)*	1	0	6
Mechanical availability (hours)*	0	1	9
	Shovel (1)	**Shovel (2)**	
Profit contribution (@shovel)	100	60	

* When shovel 2 is mechanically unavailable, shovel 1 is limited to **6 hours**. Likewise, when shovel 1 is mechanically unavailable, shovel 2 is limited to **9 hours**.

1. Formulate the LP models using these details **(10 Marks)**
2. Graphically solve the problem **(5 Marks)**
3. Compute the total profit **(5 Marks)**
4. Compute the slack (if any) **(5 Marks)**
5. Mark an intelligent conclusion by taking the slack into consideration **(5 Marks)**

QUESTION 2 **[30 Marks]**

A dispatch mine engineer is asked to improve the truck-shovel productivity on a daily basis. There are 3 shovels serving a single line of haul trucks at a bench face on a first-come first-serve basis. A study shows that average of 20 trucks arrives to join in the queue according to Poisson distribution and average of 8 trucks are being served per hour. Determine the productivity based on the truck-shovel relationship. Note that we assume that the number of trucks in the system is unknown.

(a) Use a suitable queue model to determine the productivity **[10 Marks]**

(b) If the waiting time is >15 minutes, make a recommend to the management for an improvement (show your calculations) **[10 Marks]**

(c) If allowable production is 7,000 tonnes per truck, what is the productivity loss (gain) caused by the queue system? for each option calculation) **[5 Marks]**

Please make an overall conclusion of your findings **[5 Marks]**

(*Use the Table if you which to reduce calculation times*)

QUESTION 3

[30 Marks]

A mining company XYZ uses explosive at a demand rate of 1,215,000 tonnes per year from Dyno Westfarmers at an ordering costs of $1,200 per tonne. It costs XYZ $350 at various inventories before it reaches the mine site. The mine operates for 340 days accounting for weekends and holidays. Determine the following:

(a) Optimum order quantity per order **[5 marks]**

(b) Minimum total annual inventory costs **[5 marks]**

(c) Reorder point **(5 Marks)**

(d) Number of orders per year **[3 marks]**

(e) What is the cycle time before each order can be placed? **[2 marks]**

(f) Summarise the results, clearly stating each parameter obtained for the order cycle **[5 marks]**

(g) If an alternative supplier gives a reduced order cost of $1,000/t of explosives and with $300 inventory costs, compute and compare the total Q_{opt} and Tc with that of the original ones (parts *a* and *b*). **[5 Marks]**

THE END

MARKS WILL BE ALLOCATED FOR GOOD ANALYTICAL CONCLUSIONS