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 2021

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**

PART 1: MULTIPLE CHOICE QUESTIONS (2 MARKS EACH)

QUESTION 1

Which of the following are suitable features of a competitive market structure?

a) firms are free to enter and free to exit
b) there are too many barriers to entry
c) firms are price takers
d) price is determined by few suppliers
e) a and c are correct
f) all of the above

QUESTION 2

Which of the following are suitable features of a monopoly market structure?

a) firms are free to enter and free to exit
b) there are too many barriers to entry
c) firms are price takers
d) price is determined by few suppliers
e) a and c are correct
f) b and d are correct

QUESTION 3

What are the key features of competitive strategy?

a) cost leadership
b) product differentiation
c) focus
d) customer relationship
e) all of the above
f) a, b and c are correct

QUESTION 4

What is corporate strategy?

a) add value through selecting, resourcing, controlling & promoting
b) market growth and high market share
c) focus
d) customer relationship
e) all of the above
f) a and b are correct

QUESTION 5

What does Porter's third strategy of "focus" relate to?

a) meet customer relationship and demand
b) specific product, market location and particular industry (e.g., mining)
c) differentiated business model
d) customer satisfaction

QUESTION 6

The objective of a linear programming is to:

a) mix two or more products for an optimal outcome
b) optimize the use of scarce resources to maximise profit
c) minimize resource wastage and costs thereby optimizing cost and maximise benefit
d) all of the above

QUESTION 7

The objective of a queuing model is to:

a) optimize productivity
b) optimize production through minimizing the waiting time for a certain activity
c) since time is money, a server must work faster
d) all of the above

QUESTION 8

What is the underlying feature of a queuing model?

a) optimize productivity
b) calling population must not exceed the service rate
c) arrival rate must exceed the service rate to shorten the waiting time
d) service rate must exceed the arrival rate to shorten the waiting time
e) all of the above

QUESTION 9

What is the main objective of an inventory model?

a) to make sure FIFO of material inventory is sequenced properly
b) to make sure inventory cost is minimized all the time
c) to ensure the continuity of a production activity by maintaining a safety stock of materials
d) to ensure the continuity of a production activity by order materials for stockpiling at any interval
e) all of the above

QUESTION 10

What does "*bias for action*" mean in strategic management?

a) doing task to one's best ability using available resources
b) wait for someone to start the project for you
c) getting a slow start on a project incase you make a mistake and you get fired
d) all of the above

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 Shovel (1)	Shovel (2)	Required quantity of each factor/resource
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 an average of 20 trucks arrive 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) What is the productivity loss if planned production is 70,000 tonnes per truck/day, (gain) caused by the queue system? **[5 Marks]**

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

(Use the Table if you want 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