

Operations Management

Final Exam

22/6/2011

Duration 2h30m

Good Luck!

Remember the following tips:

- Budget your time. Skim through the exam before starting.
- Show all your work to allow us to give you partial credit if appropriate.
- Answer groups in separate pages and please write down your name in all pages.

Question 1 (80 points)

1) (15 points) Tony at the bicycle shop has made a list of bikes that wait for repair. After he is done with disassembly and repair, Johnny takes over for cleaning and reassembly. The table below provides Tony's and Johnny's estimated processing times in minutes. What is the optimal sequencing for completing these six units?

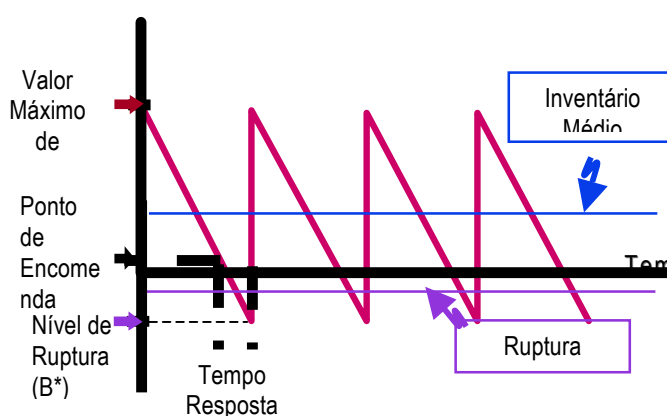
	A	B	C	D	E	F
Tony	44	36	20	24	30	64
Johnny	28	38	26	56	42	22

2) (15 points) At the drive-through counter of a fast-food outlet, an average of 10 cars waits in line. The manager knows that, on average, 2 cars per minute try to enter the drive-through area, but 25% of these cars are dismayed by the line and leave without entering the line and placing orders. Assume that no car entering the line leaves without service. On average, how long does a car spend in the drive-through line?

3) (10 pts) Show that in fixed-quantity system (Q) with backorders, the economic order quantity can be two times the amount of an equivalent model without backorders, if the holding cost is three times the backorder cost?

4) (10 pts) What are the main differences and implications of having a finite population vs. a infinite population in a waiting line model?

5) (10 pts) The figure illustrates the EOQ with backorders. If D is the annual demand, C cost per unit, S cost of placing an order, H annual inventory cost per unit, please develop and explain the expressions for a) maximum inventory level; b) total annual costs; c) optimal order quantity; and d) optimal backorder level.



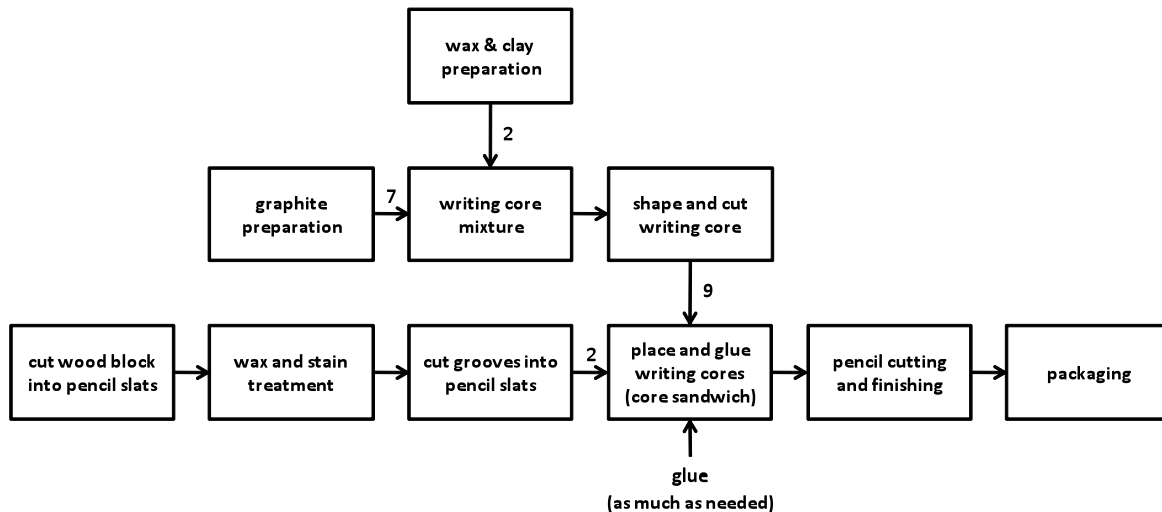
6) (10 pts) Can JIT and MRP be classified as pull and push system, respectively? Why?

7) (10 points) What is user innovation? Give 3 examples of user innovations.

Group 2 (35 points)

PencilCo is a manufacturer of notable high quality pencils, sold on specialty stores and mainly bought by drawing artists. PencilCo's drawing pencils are renowned for being made out of the best materials (e.g. northern cedar for the wooden casing and fine graphite and clay powders mixture for the smooth writing core) throughout the whole production process.

That manufacturing process consists of 10 main activities as presented and characterized on the following diagram and table:



	Activity	Capacity per hour	additional information
A	cut wood block into pencil slats	300 slats	-
B	wax and stain treatment	275 slats	-
C	cut grooves into pencil slats to place writing cores	250 slats	-
D	graphite preparation	1,19 liters	-
E	wax & clay preparation	0,30 liters	-
F	writing core mixture	1,62 liters	2 parts of wax & clay : 7 parts of graphite
G	shape and cut writing cores	2520 writing cores	1 liter of writing core mixture is used to produce 800 writing cores
H	place and glue writing cores to pencil slats (i.e. build core sandwich)	112 sandwiches	9 writing cores : 2 pencil slats
I	cut pencils from slats and apply lacquer finishing and brand	1017 pencils	9 pencils are produced from 1 sandwich
J	packaging	60 packages	each package includes 18 pencils

- What is the system capacity, in terms of packages per hour?
- Identify which activity (or activities) is limiting the whole system production capacity.
- How much slack does each activity have, in terms of final product (i.e. pencil packages) per hour?
- PencilCo's COO (Chief of Operations in Office) is evaluating a possible scenario of upgrading the existing capacity of activities A and J, to 400 slats per hour and 100 packages per hour, respectively. You have been asked to advise on that.
 - What would be the new system capacity after this upgrade?
 - What would be your advice: to go forward with the proposed upgrades, or not? And why would you advise that way?

Group 3 (20 points)

Mr. João wants to open a new toys store (TOY) in Lisbon. He has two possible suppliers, a national supplier or an Italian supplier and is analyzing which one is better. If he chooses the national supplier orders will be placed every 8 days and he will order an amount of 1600 toys. The order will take 2 days to arrive the store. If he chooses the Italian supplier orders will take place every 15 days and it will take 4 days to arrive the store. In this situation he will order 3000 toys. Assuming that daily demand of toys is 150 with a standard deviation of 40. Once the store is not opened yet assume that the current inventory level is zero.

- What is the level of safety stock in each situation?
- Which supplier should the manager of this store choose taking into account that he wants the one that allows higher customer service level?

Group 4 (40 points)

You have completed your Management degree and you were hired to work on Makinsei, one of the biggest consultancy companies in the world. Your first project is to organize the opening of the first Portuguese store of the famous American brand Apresrombie & Fich.

So, as project manager, you have to develop the activities described in the table below, taking into account the predecessors also indicated in the table:

Activity	Description	Time (Weeks)	Predecessors
A	Identify Store Location	6	
B	Close Rent Contract	3	A
C	Choose initial collection	3	A
D	Decorate Store	4	B
E	Hire Personnel	4	-
F	Train Personnel	3	E
G	Receive Collection	8	C
H	Place collection in the store	2	D, F, G
I	Advertise and send invitations for opening	2	H
J	General Reversal	1	H
K	Final Preparation and Grand Opening	1	I, J

- Present an activity-on-arc network diagram for this project
- Calculate the early start (ES), early finish (EF), late start (LS), late finish (LF) for each activity and include those values in the diagram
- Calculate the slack for each activity and indicate the critical path of the project and its length in weeks.
- Due to the impact of the Christmas Season on sales, you were informed that the store has to open on the second week of November, leaving you only with 19 weeks available to complete the project. You collected the data below to help you identify the best way to shorten the project (you were also informed by the Portuguese partner that banks were getting nervous and so you would have to choose the less expensive options). Show how to crash the project to reach the objective

Activity	Total Crash Cost (€)	Weeks Crashed
A	1.400	2
B	2.500	1
C	1.500	1
F	1.000	1
G	4.200	3
I	1.200	1

- What is the total cost of the crash and which is the new critical path?

Group 5 (25 points)

You purchase motors from a supplier at \$100 apiece, and you experience a steady demand of 100,000 motors each year. It costs your company \$1,000 to place an order (which includes the cost of shipping the motors), and each motor costs \$20 per year when held in inventory. Once you place an order, it takes 2 weeks to get the shipment of motors.

- a) Currently, your company purchases 10,000 motors at a time. What is the total annual cost to your company (including the cost of the motors themselves) associated with ordering motors in this lot size?
- b) How many motors should your company order each time in order to minimize total annual costs?
- c) Your company has just switched to a new electric motor supplier. This new supplier is offering a 2% price discount if your company orders quantities of 20,000 motors or more; if you order less than 20,000 motors each time, you will pay the regular price of \$100 apiece. How many motors should your company order each time in order to minimize total annual costs?
- d) Assuming that there are 50 working weeks in a year, what is your inventory reorder point for these motors?