Practice Problems for Final Exam—Fall 2007

1. Your family (or dormitory or group of friends) is planning a trip to the Sierra Nevada mountains during the break. The group has decided that one of your activities will be to make a snowperson. However, you know that your younger sister (or roommate, or best friend) would prefer to ski, and would like to finish the snowperson as quickly as possible. You decide to calculate the time it will take to build the snowperson. From previous years' experience, you have an understanding of the activities involved and a good estimate of the time required to complete each of them.

Activities	time (in minutes)	immediate predecessors
A. roll head	15	----
B. roll middle	20	----
C. roll bottom	25	----
D. put middle on bottom	10	B,C
E. put head on middle	5	A,D
F. find and put on button nose	5	A
G. find and put on 2 eyes made out of coal	7	A
H. find and put on branches for hands	10	D
I. find and put on corn-cobb pipe	5	E
J. find and put on old silk hat	5	E,F,G

(a) Draw an activity-on-arc network for this project and identify the critical path. (You may find the critical path by inspection.) Assuming the team is large enough to handle many parallel tasks, when how long will the project take?

(b) The members of the team think the variance of each task's processing time is about 40% of the corresponding mean. What is the probability that the project will not be finished in 1 hour?

(c) Your mother (or dormitory resident assistant) hates cold weather. She is willing to do her share of the work, but doesn't want to stay outside for the entire time while the snowperson is being constructed. She thinks the snowperson should be constructed by allocating the work evenly among 4 people. The first person will complete his/her share of the work, then turn the project over to the next person, and so forth. The team agrees that each activity should be completed by one person (not divided between two people) to minimize any confusion. Propose a good way to divide the work.

2. A particular job shop that handles very large parts has three major processors that are physically connected to each other, with some work-in-process storage space in between. Machine A is performs several metal removal operations. Machine B performs metal finishing for products requiring smooth finishes. Machine C is an inspection station. Current union rules require that an operator be assigned to each machine whenever any of the machines is running.

Jobs have various routes through the shop, but all jobs must go through machine C. The following jobs must be completed before the end of the year. (Times are in hours.)

Job	t_A	t_B	t_C	due date	Routing
1	9	4	4	24	A-B-C
2	2	1	6	40	A-B-C
3	5	2	2	40	A-B-C
4	7	4	5	32	A-B-C
5	1	--	1	32	A-C
6	8	--	3	48	A-C

(a) What is the optimal sequence if the employees are paid hourly and the owner wishes to minimize labor cost?

(b) The owner now realizes that his profits are being adversely affected by idle time on the finishing machine (Machine B). As a consequence of new negotiations with the union, operators can be sent home whenever they are finished for the week, and paid only from Monday morning until they are sent home. What schedule would you recommend and why?

(c) The customer who ordered Job #1 is getting anxious and wants to know when his order will be finished. The owner had been worrying about labor costs, but now realizes that he also has to worry about due dates. Ignoring labor costs, propose and justify a schedule that has good due-date performance.

3. Match the cases to the zero, one or two most relevant concepts or models. You may list each concept or model more than once.

Scenario / case — Matching item(s) Concept or Model

a. Glu-Lam _____

b. Midwest Stamping_____

c. Lawn King _____

d. Benetton _____

e. American Semiconductor_____

f. B's Wax Candles _____

Please explain anything that may not be obvious to the grader.
Explanations:

A- EOQ/EPQ
B- Quantity Discounts
C- (Q,R) models
D- (s,S) models
E- Newsvendor model
F- (S,T) model
G- Product Cycling model
H- Exponential smoothing
I - Winters' model
J- Aggregate Planning
K- MRP
L- JIT
M- Kanban
N- Flow shop scheduling
O- Dispatching rules
P- Job shop scheduling
Q- Wagner-Whitin Algorithm
R- Silver-Meal Algorithm
S- Critical Path Method
T- Assembly Line Balancing
U- Flexible Mfg. System
V- Postponement
W- U-shaped production line
X- Distribution Req. Planning
Y- Design for Manufacturing
Z- Bullwhip effect

Essay questions

Note #1: The essay questions are designed to test your deeper understanding of the subject matter and your ability to use what you (should) have learned in this course to analyze realistic problem scenarios. The essay question(s) on the exam will not necessarily have the same structure as the questions below, but these questions are provided to help you prepare.

Note #2: It is important that you answer the stated question. Writing statements that are accurate but do not answer the question will not earn you any points. (Of course, writing inaccurate statements will not earn you any points, either.) It is unlikely that anything copied from the book would directly answer any of the questions. Nevertheless, copying material from the book is expressly prohibited and will be grounds for a total score of zero on the examination.

Choose 3 of 5 questions. Please limit your answers to 300 words—about 1.25 pages—for each essay. The difficulty of the question will be considered in the grading process.

A. Both project scheduling techniques and various job shop scheduling procedures have the objective of minimizing the completion time (makespan). Thoroughly explain the similarities of, and differences between, these techniques in a situation where the goal is to minimize makespan.

B. Both MRP and some form of aggregate production planning are used in many manufacturing companies. Explain how the two systems should interact. Examples of a few issues to address are: (i) How and what type of information should flow between the two systems? (ii) How should lot sizes be determined? (iii) How should fundamental differences in the assumptions be resolved?

C. A company purchases components and assembles them into finished products using an assembly line. The demand for all products is constant over time. The assembly line can be balanced for each of the finished products separately, incurring a setup time and a setup cost each time the line is rebalanced. Alternatively, the line can be balanced for an "average" product, and this arrangement can be used for all products without incurring setups. Explain in detail how you would design the two alternatives and compare them.

D. Compare and contrast a kanban system with TWO of the following: (i) a (Q,R) inventory system, (ii) an (s,S) inventory system, (iii) an order-up-to-S system, (iv) an (S,T) inventory system.

E. Discuss how the design of a new forecasting system should be influenced by (i) a retail company's *existing* inventory control system (which might be a just-in-time system for some products) and (ii) a manufacturing company's current lot sizing system. **Do not** discuss how the inventory system should be influenced by the forecasting system.