NAME (please print):_____

UTID:_____.

Cohort: 1 2

BA380N Operations Management

Final

Spring 2008

Professor E. G. Anderson
McCombs School of Business

Instructions:

- You are allowed two (2) 8 ½" x 11" formula sheets for reference, a calculator, pencils, a ruler, and ***no other aides, books, notes, etc***.
- You should have 11 pages including the z-chart.
- Place your answers in the space provided, and circle the numeric ones.
  - Don't linearly interpolate on the z-chart. Just pick the nearest value and use that entry.
- For short essays, please keep them to the space provided (remember: brevity is the soul of wit).
- Make sure you print your name and UTID at the top of the page.
- Complete all scratch work etc. on the sheets in the exam provided.
- DO NOT START UNTIL TOLD TO DO SO

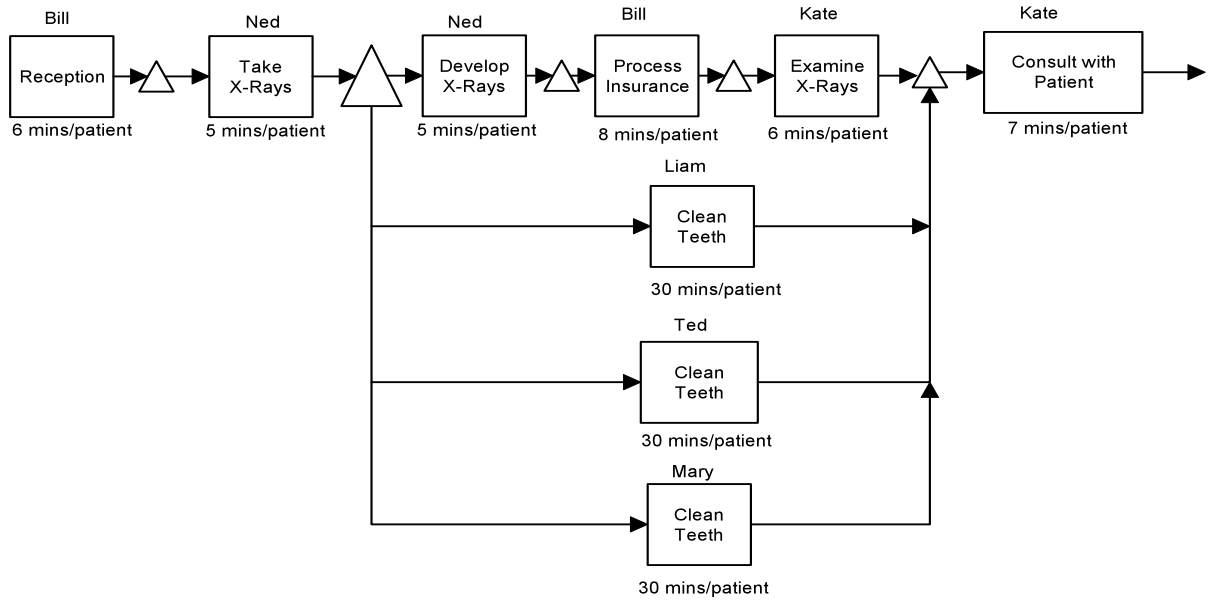
Instructions: You have 2 ¾ hours to complete the exam. Please count all your pages and read over all your questions before beginning on a particular problem. If you get stuck on a question, move on to the next one, since they are not generally cumulative. Partial credit will be given for incorrect answers if work is shown. Feel free to use the back sides of previous pages for scratch work.

Points per Section

1.	Process Analysis	24 pts
2.	Project Management	8 pts
3.	Inventory Management	10 pts
4.	Queuing	8 pts
5-8	Short Answers	10 pts each
	Name, UTID, & Cohort	10 pts
	Extra Credit	2 pts

Good luck... C

(1) (20 points) **Process Analysis:** Below is a diagram for the Longhorn Dental Clinic. Bill, the office manager, received his BBA from the University of Texas at Austin ('97). Because he is a disciple of lean services, he realizes *that he should not schedule appointments to arrive at a faster rate than the clinic can finish them*. A diagram of the clinic's process is given below.



a. What is the process capacity in patients per hour (8 pts)?

Resource	LC
Bill	14 mins
Ned	10 mins
Kate	13 mins
Hygeinists	33% * 30 + 10% * 0 mins

B-neck is either Bill. his Labor content is 14 mins/patient
→ Cproc = 1 pat/14 mins * 60 mins/hr = 4.29 patients/hr

b. What is the rush-order flow time through the clinic (4 pts)?

6 mins + 5 mins + max(5 mins + 8 mins + 6 mins, 30 mins) + 7 mins = 48 mins/patient

c. Assume that a patient arrives every 20 minutes, what is the average utilization of the labor resources as a whole (4 pts)?

$u = 1/6 * (u_{Bill} + u_{Ned} + u_{Kate} + 3 * u_{Hygeinists})$ $= 1/6 * (14/20 + 10/20 + 13/20 + (3 * 10/20)$
$= 55.8\%$

d. Consider instead a mortgage approval process. If it has a process capacity of 30 clients per month and a bottleneck utilization of 75%, its cycle time in days per client is (assuming 30 days per month) (4 pts)?

CT = 1/Capacity = 1 month/30 clients * 30 days/month = 1 day/client

e. What is the throughput of the mortgage approval process described in part (d) if the process yield is 100% (4 pts)?

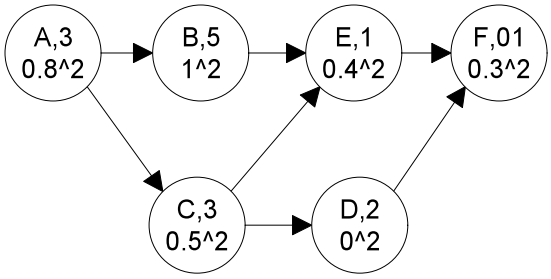
u = thruput/capacity → thruput = u * capacity = .75 * 30 = 22.5 customers/month

(2) **Project Management:** For the next two questions, consult the following table and use the standard PERT methodology. (The percentage next to the responsible engineer indicates how much of that engineer's worktime is used up while working on this activity, i.e. 100% indicates that the employee will be utilized full-time while working on that activity.)

	Expected Duration (months)	Std. Dev* (months)	Responsible Engineer	Predecessors
A	3	0.8	Tom (100%)	
B	5	1	Jerry (100%)	A
C	3	0.5	Bill (100%)	A
D	2	0	Garfield (100%)	C
E	1	0.4	Felix (100%)	B,C
F	1	0.3	-	D, E

*Note: This is not the variance!

a.) (6 pts) What is the probability that you will complete this project within 12 months? What would the probability change to if Garfield were called off to another project and Jerry had to perform Garfield's activity as well? (Assume Jerry is as effective as Garfield at Activity D.)



CP: ABEF, Mean = 10, Std Dev = SQRT(.8^2+1^2+.4^2+0.3^2) = 1.37
Z = (12-10)/1.37 = +1.46 ➔ Pr (Tcp <= 12) = 92 or 93%

If Jerry replaces Garfield, it adds a dependency from B to D. Now the CP is ABDF. The mean is 11. The std dev is SQRT(.8^2 + 1^2 + 0^2 + 0.3^2) = 1.32.
Z = (12-11)/1.32 = +75.8 ➔ Pr (Tcp <= 12) = 77.6%

b.) (2 pts) Assume that each engineer is paid $10,000 per month for his or her work on the project. What budget can you give to your manager that you can guarantee (with 95% certainty) that the project will not exceed? **(**In other words, you should only have a 5% chance of money spent on this project exceeding this budget.) You may assume that there are no indirect costs.

Mean = 14 months, Std Dev = SQRT(.8^2+1^2+.4^2+0^2+.5^2+0.3^2) = 1.46 months, z=1.64
Budget = 10,000 * [15 + 1.64*1.46] = $174,000

(3) Inventory questions

Jeannette McKeen, president of the UT MBA alumni association of Boston, is planning the association's annual holiday dinner for the Boston Area. Tickets to the event are $75 each, payable at the door. Catering costs are $40 per guest. An estimate must be given to the caterer one week in advance. Based on previous experience, the average number of people who show up for this event appears normally distributed with a mean of 300 attendees and a standard deviation of 20% of the mean. Johanna's problem is two-fold. One, she has to pay the caterer based on her estimated attendance rather than the actual. If too few people show up, that is not the caterer's problem. On the other hand, if too many people show up, some alumni will have to be turned away at the door. This has been shown to result in a reduction of $50 per person turned away in future contributions.

a) (4 pts) What attendee estimate should Jeanette give the caterer? How would this estimate change if you had to pay catering costs of $10 more for each of the first 50 guests (i.e. an event with 50 guests would cost $2500, an event with 51 guests, $2540)?

Mean = 300, std dev = 60, C = 40, P = 75, V =0, G =50,
Cu = P-C+G=75-40+50 = 85, Co = C-V = 40 – 0 = 40
➔Service Level = 85/(85+40) = 68% → z = +0.48 → Q* = 300 + .48 * 60 = 329 iPods

b) (2 pts) Assume that Jeannette gives an estimate that results in a service level of 85% (this may or may not be the correct service level for part a). In this case, what is the expected number of ticketed attendees that Jeannette should expect to show up on the night of the banquet?

85% → L(z) = 0.077

ES = mean – ELS = 300 – (0.077)*(60) = 295 attendees

c) (2 pts) MULTIPERIOD INVENTORY: Jeannette's brother Evan runs a computer store in Cambridge that specializes in Apple products. He sells 2, 4, and 8 GB iPods. The demand for each type of iPod per week is normally distributed with a mean of 80 and coefficient of variation of 30%. He is open 7 days per week. He places an order each Monday to replenish his 2 GB iPods. The lead time from the factory is 3 days. What should his safety stock of 2 GB iPods be if he wants a service level of 95% per reorder cycle?

Mean = 80 ipods/week , std dev = .3 * 24 = 16 iPods/week, LT = 3/7 week, T = 1 week,
Service level = 95% → z = 1.64

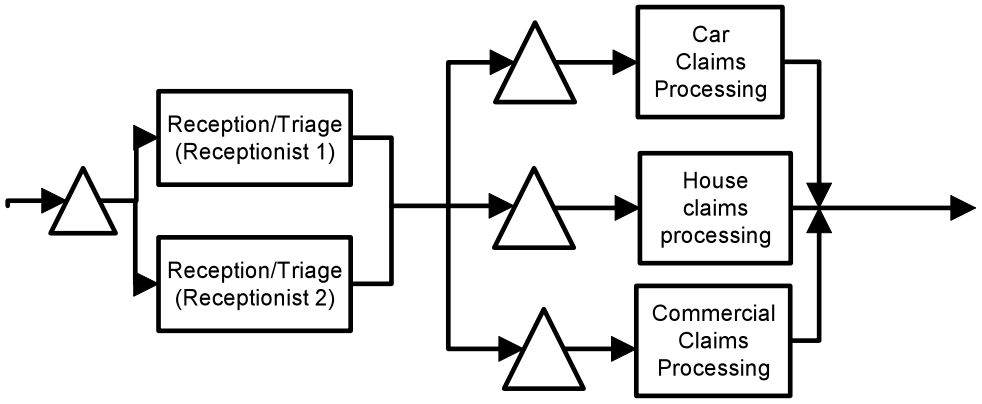
SS = z * sqrt (LT + T) * std dev = 1.64 * sqrt(3/7 + 1) * 24 = 47.0 iPods

d) (2 points) For part c, what is the probability of a stockout over an entire year?

1 - 0.95^52 = 93.1% (or something close, rounding error may be high)

(4) Queuing questions:

Refer to the diagram below for question 3. The Bee Cave branch of All-State Insurance operated a telephone service operation for claims processing as shown below. Calls from customers arrive at a rate of 30 per hour. One of two receptionists then greets the caller and "triages" the call by routing it, depending on the type of claim involved, to one of three claims specialists. Each receptionist can triage 18 calls per hour and has a coefficient of variation for his service time of 100%. Assume 40% of calls go to the car specialist, 30% to the house specialist, and the remainder to the commercial specialist. The Car, House, and, Commercial claims specialists each have a processing rate of 12.5 calls per hour and each specialist has a standard deviation in their service time that is 10% of the mean service time. Assume that the calls arrival times at triage are not correlated with one another.



a) (4 pts) Providing an extra server to which operation would most reduce the average flow time for all customers through the entire process depicted above? By how much would the flow time be reduced?

Reception/Triage

M	λ	μ	u	Lq=u^sqrt(2(M+1))/(1-u) * (CV^2_{iat} + CV^2_{st})/2	Wq=Lq/λ
2	30	18	83.3%	3.84 claims	7.68 mins
3	30	18	55.6%	0.43 claims	0.86 mins
Delta					6.82 mins

Car Claims Processing (can ignore the others as they have lower utilizations & Same CT, M)

M	λ	μ	u	Lq=u^sqrt(2(M+1))/(1-u) * (CV^2_{iat} + CV^2_{st})/2	Wq=Lq/λ
1	12	12.5	96%	11.63 claims	58.18 mins
2	12	12.5	48%	0.16 claims	0.80 mins
Delta					57.38 mins
Weighted Delta @ 40% of Thruput					22.95 mins

Answer = 22.95 mins

(4 pts) Qualitatively, what are the potential advantages of pooling the queues prior to the claims specialists? What factors could invalidate these potential advantages?

Presumably the receptionist/triage CT will shrink as they will no longer have to triage, improving flowtime or a receptionist might be let go.

The waiting in front of the claims specialists should shrink with pooling into one queue.

If, however, the different claims specialists are too specialized, their decrease in capacity might increase the waiting time and/or increase in defect rates might actually decrease customer satisfaction.

END OF QUEUING QUESTIONS. PROCEED TO THE NEXT PAGE.

(5) (10 points) From an operations standpoint, describe 3 principles of the Toyota production system (TPS) that Southwest Airlines does have in common with Toyota? Describe 2 TPS principles that Southwest does not follow.

(6) (10 pts) The law firm of Mallios and Associates has for many years made a lucrative practice of specializing in bringing relatively strong malpractice suits against hospitals. They are thinking of moving into dissimilar areas of tort litigation such as product liability suits. As a strategic planning consultant hired by Mr. Mallios, would you recommend that he diversify into this new field? Why or why not? Justify your answer from a service operations perspective, considering both long- and short-term costs.

(7) (10 pts) In *The Goal* what is the main method (other than high utilization) suggested for detecting a bottleneck? Describe a real-world situation in which this rule will not work.

(8) (10 pts) The Lean 6 Sigma for Service operating strategy preaches a drive towards ever-decreasing amounts of WIP. Give three reasons for this drive in services. Describe a situation under which having a large amount of WIP in services might be acceptable.

Extra Credit (2 Points): Who was the person who first systematized Total Quality Management and what company did he work for?