ME101, Midterm Examination, Fall 2008

Name ________________________________

Closed Book Examination (one 3”x5” card of handwritten notes, one side, allowed)

Time Limit:  80 minutes

p.2 (17 pts possible) ___________
p. 3 (12 pts possible) ___________
p. 4 (5 pts possible) ___________
p. 5 (16 pts possible) ___________
p. 6 (14 pts possible) ___________
p. 7 (15 pts possible) ___________
p. 8 (13 pts possible) ___________

TOTAL ___________

READ THESE INSTRUCTIONS!

Total Points Available: 92
Values as marked.
10 pages, not including this cover sheet. Make sure you have all the pages!

Do not start until told to begin.
Write your SID at the top of every inside page when you are told to begin.
1. (17 pts as marked) Please choose one or more correct options and explain your answer.

   a) 5pts Higher (MCE) (utilization of your most expensive machine) (inventory turns) (WIP) (EMQ) (none of these) is/are always desirable.

   b) 4pts EMQ finds the optimal tradeoff between the following: (throughput time)(wait times) (inventory turns) (shortage costs) (demand) (setup costs) (WIP) (holding costs) (processing costs).

   c) 6pts Which of these correctly defines the relationship between the different manufacturing times?
      a) Throughput = Processing time <= MLT
      b) MLT <= Throughput <= Processing time
      c) Cycle time <= Throughput <= Processing time <= MLT
      d) Processing time <= Throughput <= MLT
      e) Throughput <= MLT <= cycle time
      f) none of the above

   d) 2 pts In moving from the age of craft production to the current high mix, low volume manufacturing age, a) worker skill decreased, b) worker skill increased, c) worker skill increased and then decreased, d) worker skill decreased and then increased, e) worker skill remained unchanged.
2. (4 pts) Demand for fubars is steady (neither increasing or decreasing on average) and normally distributed, with a mean of 47 per week and a standard deviation of 5. What is the probability that demand this week can be met from stock if 42 fubars are in inventory? Show your work, perhaps with the aid of a sketch.

3. (8 pts) Find the uniform annual cost of an NC machine tool that costs $92,000 to purchase new, has a 10-year expected life and an expected scrap value of $9,000 at the end of 10 years, costs $2/hour of operation to maintain, and will be run for 16 hours a day, 300 days a year. Use a 18% annual interest rate. (Engineering Economics tables are attached at the back of the exam.) Show your work.
4. (5 pts) For the demand data series given, indicate what model covered in class is the best choice for forecasting future demand and explain why. Graphs of least squares fits (linear, exponential, and polynomial) and exponential smoothing predictions (with two different alpha values) are shown for each data series.

a) Circle best choice:  
   i) linear  
   ii) least squares exponential  
   iii) least squares polynomial  
   iv) exponential smoothing alpha = 0.05  
   v) exponential smoothing alpha = 0.3  
   vi) Winter’s method

Explain why:

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5. (8 pts) The average unit labor cost for making the first 3 products when setting up an industrial assembly line was found to be $75 ($225 to make all 3). The learning rate was measured to be 75%. Estimate the cost of making the 4th such product based on the theory of learning curves.

6. (8 pts) Using Winter’s method, forecast enrollment for Fall 2006 given the following data sequence.

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7. (6 pts) You are a beer distributor. You have sub-contracted order processing and delivery to your cousin Joe (because you feel badly that he cannot get plumbing jobs anymore without a license). Joe charges your retail customers directly for his services, so you neither make nor lose money on order processing or delivery.

You have two customers in Berkeley, Saloon A and Saloon B, both with normally distributed beer demand, with equal mean demand and equal standard deviation. Saloon A places beer orders every day. Saloon B places beer orders every week. All else being equal, which do you prefer as a customer and why? (Do not take Joe’s preferences into account.)

8. (8 pts) An off-shore pill factory has a work-center that takes 50 minutes to set up for each type of pill and 2 minutes of processing time at the work center to process one bottle of pills. The work-center costs $6 per hour to set up or to run, including labor and overhead. A study has shown that pills spend about three-fourths of the time waiting for further processing (and the other one-fourth is spent in setup and actual processing). The factory operates 2500 hours per year. Holding cost rate is estimated at 50% per year. Demand is 360 bottles/month for pill A. Materials cost for each bottle is $0.30. Find the optimal production batch size.
9. (15 pts) For the manufacturing of its anvils, Acme Inc. uses five manual stations in a synchronous flow line as shown below with operating cycle times in hours as indicated. Transfer/repositioning time between stations is 1 minute.

![Assembly Line Diagram]

The current demand is being met exactly with this assembly line. Acme is studying whether to overhaul the line and replace the workers with robots because of repetitive stress injuries. The stations manned by robots will operate the same number of hours as the current manual stations, with the same transfer/repositioning time between stations. The minimum rational work elements and their task times for the robots are given in the table.

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<th>Immediate Predecessors</th>
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a) Draw a precedence diagram, find the positional weight of each element, and balance the assembly line using the RPW technique.

b) If each manual station is run by a single worker, whose wages, workman’s compensation insurance, and other overhead cost a total of $50,000/year, and each robot costs $100,000 to purchase and install and $5,000/year to maintain, what is the break-even point in years for purchasing the robots?
10. (13 pts) A work center produces 2 products, A and B. It operates 40 hours/week. Setup times, processing times, and daily demand are given in the table. Labor costs are fixed. Find the appropriate batch sizes for the upcoming 2 weeks (5 weekdays per week) that minimize inventory cost while meeting demand.

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<td>2 hours</td>
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### Factor Table - $i = 18.00\%$

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