Assignment #6

Due: Friday, April 9, 2004

Graduate assignment is at the bottom of the page.

Problem #1:
A bike shop gives its customers a water bottle with a purchase. At present, the shop buys 50 imprinted bottles at time (a 2 months supply -- that means 300 bottles per year) for $3 per bottle. Assume the ordering cost to be $10 and the holding cost to be 2 cents/bottle/year, find the optimal order quantity.

Problem #2:
During turning operations on a Mg rod, dust is produced. The airborne dust settles at a particular rate. Airborne Mg dust represents a fire hazard. While the depth of cut is fixed for a given operation, the value for the feed may be changed. Increasing the feed reduces the operation cycle time, but also produces more dust. The following information is also known:

1. Length & diameter of part to be machined = 0.4 m & 0.2 m
2. Cutting speed = 8 m/s
3. Concentration of suspended dust, C (mg/m³), is given by
   \[ C = R \times T^B \]
   where
   \[ B = 0.6 \]
   \[ R \] is the rate of dust production (mg/s*m³),
   \[ T \] is the time (s).
4. \[ R = 2000 \times f \] (where \( f \) is specified in m/rev)
5. \[ \text{Prob(Fire)} = 0.001 \times C \] (where \( C \) is the concentration at the end of the operation)

Prepare two plots. One plot should display machining time as a function of feed, and the other the probability of a fire as a function of feed. Based on the plots, select a feed - explain your rationale.

Problem #3:
An industry discharges 30,000,000 gal/day of wastewater containing 0.1 mg/L of lead (the limit for domestic water use) into a large river that serves as a drinking water source for a nearby community. The river flow is 50,000 ft³/sec. Assume that all lead is conserved (i.e., not removed) and evenly mixed. The average daily per capita consumption of water is 2 L/day. What is the average yearly intake of lead due to water consumption? Give your answer in milligrams per person.

Graduate Credit:
Find a journal article concerning sheet metal pattern layout optimization (nesting algorithm, tesselation, etc.). Provide (i.) a summary of the article and (ii.) a critique of the article. Keep your review one page. Be complete and concise. Include a copy of the article.