Production line behavior

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Due **Day 23**

To do this problem, you must use the tools available on `http://cell1.mit.edu/`.

Consider a production line that has four machines with the same parameters: $r_i = .075$, $p_i = .009, i = 1, 2, 3, 4$.

1. **Variation of N_i**

   (a) Assume $N_1 =$ and $N_2 = 30$. Let N_3 range from 3 to 300, and plot the resulting values of $\bar{n}_1$, $\bar{n}_2$, and $\bar{n}_3$ on the same set of axes. Explain the shapes of the graphs, especially why numbers are increasing or decreasing, and their limits.

   (b) **3 points** Now assume that N_3=30, and let N_1 vary from 3 to 300. Again, plot $\bar{n}_1$, $\bar{n}_2$, and $\bar{n}_3$. Explain again the graphs, and especially how they differ from the last set of graphs.

2. **Reliability optimization** With all buffer sizes set to 30, consider the effect of varying the mean time to repair of Machine 1. It costs money to make Machine 1 easier to repair; in fact, it costs \$100/MTTR$_1$. Consider the following expression for profit for running the line for a given time period:

$$\$1000E - \$2(N_1 + N_2 + N_3) - \$10(\bar{n}_1 + \bar{n}_2 + \bar{n}_3) - \frac{\$100}{\text{MTTR}_1}$$

   (a) Is this function reasonable? Explain what each of the terms means, and why it belongs there.

   (b) What is the most profitable value of MTTR$_1$?

   (c) Does the answer make intuitive sense?