Tufts University
Department of Mathematics
Math 87 Homework 7

Due: Thursday, November 29, at 1:30 p.m. (in class).

For this assignment, you will need to download two files, `strategy1.m` and `strategy2.m` from the course webpage, `http://neumann.math.tufts.edu/~scott/math87_F12`. Note that both of these codes require you to first set a parameter "quiet" that controls the amount of output generated. If "quiet" is set to 1, no text output is given; otherwise, a full report is generated.

1. (20 points) Suppose the storage cost for one tank for one day is \$1. How much profit, on average, does Joe's Fish Tank Emporium (JFTE) need to make on each tank to cover the storage costs for each strategy? To justify your answer, write a matlab code that repeatedly calls `strategy1.m` or `strategy2.m` (to run a single 2-year simulation) and average the results over many runs. Provide a graph that convincingly shows that your answer is close to the value predicted by the law of large numbers. Based on these results, conclude which strategy is more likely to be profitable for JFTE.

2. (30 points) Consider a model whereby the probabilities are not uniformly distributed over the days of the week but, rather, they are distributed as

Day	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Prob	0.08	0.04	0.08	0.12	0.25	0.27	0.16

   Modify `strategy1.m` and `strategy2.m` to account for these non-uniform probabilities and re-run your trials from Question 1. Does your conclusion change? Experiment with the day-of-the-week on which the fixed delivery arrives for Strategy 1; which days are the best and worst choices, in terms of the minimum profit-per-tank needed to cover the storage costs?

3. (30 points) Consider a model where fish-tank purchases are overwhelmingly concentrated on one day of the week, with the probability of purchase on that day of the week (suppose it is Monday) given by p, and the probability of purchase on any other day of the week given by $(1-p)/6$. Experiment with the value of p, and report how preferential purchasing on that day must be before Strategy 1 is the better strategy. Discuss the limiting behavior as $p \to 1$ for both strategies.

4. (20 points) Modify `strategy1.m` and `strategy2.m` to use a binomial distribution for the probability of having customers arrive in the morning and/or afternoon (with uniform expected number of customers as 1/7 for all days of the week). Rerun your tests from Question 1 and compare the results.