Business Decision Analytics under Uncertainty
Spring 2017, Professor Eckstein
Homework 8, Due Wednesday, April 12

Q1: Staffing mobile phone repair technicians

You manage a center that performs emergency walk-in mobile phone repairs for a major phone carrier. The table at the end of this problem shows the recent historical pattern for the number of phones that need to be repaired each day. For example, on 3% of the days you need to repair 10 phone, on 4% of the days, you need to repair 11 phones, and so forth. Each phone you receive has a 28% chance, independent of all other phones, of needing a "major" repair, which takes 75 minutes. Phones that do not need a "major" repair require only a "minor" repair, which takes 45 minutes. Repairs are performed by technicians who are paid $225 per day, and can work up to 7 hours. If you do not have enough technicians to perform all the work needed on a given day, you must pay overtime to your current technicians and/or bring in outside technicians from a temporary agency -- either way, it costs you $85 per hour, but you can purchase fractions of hours.

Use a YASAI simulation to determine the number of technicians you should have on staff to minimize your average cost per day, and hand in the standard printouts. Try the values 2, 3, 4, and 5, each with a sample size of 1000. The data on the number of phones that have to fixed each day follows below.

Phones	Probability
10	3%
11	4%
12	4%
13	7%
14	6%
15	7%
16	9%
17	5%
18	3%
19	4%
20	2%
21	3%
22	4%
23	6%
24	6%
25	7%
26	7%
27	5%
28	4%
29	3%
30	1%

Q2: Inventory with a one-day delivery lag and a "blended" demand distribution

You own a retail store that sells a product for $129 per unit. Every time you order the product from your supplier, it costs you a $79 flat fee, plus $87 per unit. Each day, there is 12% chance of a traffic jam. On days with no traffic jam, demand has a Poisson distribution with a mean of 20.8. On days with a traffic jam, demand is lower, having a Poisson distribution with a mean of 12.1. On days when you have less inventory than customers, you only sell as many units as you have in stock, and the additional customers purchase the item from another store. Otherwise, any inventory left at the end of the day is carried over to the next day.

You make inventory replenishment decisions each morning when you open the store: if the amount S you have in stock when you open the store is at or below R units, you place an order for $L - S$ units (enough to bring the current stock level up to L). If you place an order, it is delivered the following morning, shortly before you open the store (and is counted as part of the opening inventory for the next day). You calculate your holding costs to be $3 per unit of ending inventory per day.

Build a YASAI simulation model for this situation, and use it to evaluate all possible combinations of R = 30, 40, 50, or 60 and L = 50, 60, 70, or 80. Simulate a time period of 100 days, with a beginning inventory of 31 units. For all inventory left in stock or on order at the end of day 100, apply a "salvage" credit of $110 per unit. With and without this adjustment, which policy gives the highest adjusted average profit? For the policy maximizing expected profit *with* the adjustment, estimate the probability that the adjusted profit for the 100 days will be at least $75,000. Hand in the standard printouts.

Hint: the YASAI function call genBinomial(1, p) will generate a 1 with probability p and 0 with probability $1 - p$; this technique may be used to simulate whether or not there is a traffic jam.