Homework 9

Question 12.1

Describe a situation or problem from your job, everyday life, current events, etc., for which a design of experiments approach would be appropriate.

Solution:

Our mood (Happy, Sad) on a particular day depends on lot of factors like how much I slept, what I am having in breakfast, had fight in morning with my girlfriend, etc. I want to experiment with these factors to measure my mood. Here design of experiments can help me in playing with these features.

# Question 12.2

# Clear environment

rm(list = ls())

# Read data

# install.packages('FrF2')

library('FrF2')

plan <- FrF2(16,10)

#

# > plan

# A B C D E F G H J K

# 1 1 -1 -1 -1 -1 -1 1 -1 -1 -1

# 2 -1 -1 1 -1 1 -1 -1 1 1 -1

# 3 1 1 1 -1 1 1 1 -1 -1 -1

# 4 -1 -1 -1 1 1 1 1 -1 1 -1

# 5 -1 1 1 1 -1 -1 1 -1 1 -1

# 6 -1 1 -1 1 -1 1 -1 -1 -1 1

# 7 -1 1 -1 -1 -1 1 -1 1 1 -1

# 8 1 1 -1 1 1 -1 -1 1 -1 -1

# 9 1 -1 -1 1 -1 -1 1 1 1 1

# 10 -1 -1 1 1 1 -1 -1 -1 -1 1

# 11 1 1 1 1 1 1 1 1 1 1

# 12 1 -1 1 1 -1 1 -1 1 -1 -1

# 13 1 1 -1 -1 1 -1 -1 -1 1 1

# 14 -1 -1 -1 -1 1 1 1 1 -1 1

# 15 1 -1 1 -1 -1 1 -1 -1 1 1

# 16 -1 1 1 -1 -1 -1 1 1 -1 1

# class=design, type= FrF2

Question 13.1 For each of the following distributions, give an example of data that you would expect to follow this distribution (besides the examples already discussed in class). a. Binomial b. Geometric c. Poisson d. Exponential e. Weibull

Solution:

1. Lot of people who purchase grocery are women.  Here, distribution will follow binomial.
2. Number of people we have to interview to find a Trump supporter in social media might follow geometric.
3. Bugs found in Subway burgers
4. Your motivation after joining a new job
5. As we grow older, wrinkles grow faster on our faces

Question 13.2 In this problem you, can simulate a simplified airport security system at a busy airport. Passengers arrive according to a Poisson distribution with λ1 = 5 per minute (i.e., mean interarrival rate μ1 = 0.2 minutes) to the ID/boarding-pass check queue, where there are several servers who each have exponential service time with mean rate μ2 = 0.75 minutes. [Hint: model them as one block that has more than one resource.] After that, the passengers are assigned to the shortest of the several personal-check queues, where they go through the personal scanner (time is uniformly distributed between 0.5 minutes and 1 minute). Use the Arena software (PC users) or Python with SimPy (PC or Mac users) to build a simulation of the system, and then vary the number of ID/boarding-pass checkers and personal-check queues to determine how many are needed to keep average wait times below 15 minutes. [If you’re using SimPy, or if you have access to a non-student version of Arena, you can use λ1 = 50 to simulate a busier airport.]

Solution:

Here, I am running the simulation for 100 users.

The number of ID/boarding-pass checkers and personal-check queues are defined as x\_ security and x\_lines respectively.

import simpy

import numpy as np

import random

env = simpy.Environment()

u1=0.2

lambda1=50

u2=0.75

scan\_min\_time=0.5

scan\_max\_time=1

avg\_wait\_max=15

x\_security=5

x\_lines=5

def airport(env,user=100):

while True:

print ('time taken by users for u2:')

u=(u2)

print(u)

#time taken by users in scan

s = np.random.uniform(scan\_min\_time,scan\_max\_time,user\_count)

a=sum(s)/user\_count

t1= u2\*lambda1/x\_security

yield env.timeout(t1)

print('Start at %d' % env.now)

t2= a\*lambda1/x\_lines

yield env.timeout(t2)

env.process(airport(env,100))

env.run(until=15\*100)