BUS 615 Test 2:

Question 1: A project manager is interested in whether or not new software will reduce his employee's project completion time on average. To evaluate the benefits of the new software, a random sample of 24 employees are chosen. Out of the 24 employees, 12 are randomly chosen to use the current software and the remaining 12 use the new software. Project completion times are as follows:

Current Technology	New Software
300	274
280	220
344	308
385	336
372	198
360	300
288	315
321	258
376	318
290	310
301	332
283	263

(a) Notice that the mean completion time using current technology is 325 hours and for the new software it is 286 hours. From this information, should we conclude the new software reduces project completion times on average? Why or why not?

(b) Write out the hypothesis test being conducted by the manager.

(b) Run the test in SAS and give the relevant values from SAS output here. What is your conclusion at $\alpha = 0.10$? What is your conclusion at $\alpha = 0.05$? What is your conclusion at $\alpha = 0.01$?

Question 2: The restaurant *Eatin Good* has a lunch special that is in direct competition with the nearby restaurant *Eatin Well*. In January 2019, both restaurants will change the price of their lunch special. *Eatin Good* will have a new price of $7.50 per lunch special, and believes *Eatin Well* will price their special according to a normal distribution with a mean of $7.6 and a standard deviation of 0.20.

There are 3 types of customers that will eat at these restaurants. Type 1 customers will always eat at *Eatin Good* no matter what. Type 2 customers will always eat at *Eatin Well* no matter what. Type 3 customers will always choose the lowest priced lunch special between the two restaurants and eat there.

40% of customers are Type 1 customers, 40% of customers are Type 2 customers, and the remaining 20% are Type 3 customers. The number of expected customers in January follows a uniform distribution between 4,000 to 6,000.

Simulate 10,000 trials of January lunches and report back the following.

(a) Average, Max, and Min profit at *Eatin Good* for the month of January
(b) Number of times *Eatin Good* had less revenue than *Eatin Well* for the month of January.

To help you set up this simulation inside of SAS, the following partially censored template is provided. You can choose to build off of this template, or create your own simulation code from scratch. In the template, the **numLess** variable in line 7 aims to count the number of times *Eatin Good* had less revenue than *Eatin Well* in the month of January.

```
1  data EatingGood;
2
3  numTrials = 10000;
4
5  priceEachGood = 7.50;
6
7  numLess = 0;
8
9  do i = 1 to numTrials;
10
11     numCustomers = rand(
12
13     numType1 = 0.40*numCustomers;
14     numType2 =
15     numType3 =
16
17
18     priceEachWell = rand(
19
20     if                    then numType1 = numType1 + numType3;
21     else
22
23     revenueGood =
24     revenueWell =
25
26
27
28     output;
29
30 end;
```

Question 3:

(a) Suppose the retail company *Two for One* has two locations. At location 1, there is a 35% chance for positive profit, a 35% for zero profit, and a 30% chance for negative profit on any day. At location 2, there is a 55% chance for profit, a 30% chance for zero profit, and a 15% chance for negative profit.

We wish to simulate the chance of profit for *Two for One*. In the simulation, **profit1 = 1** when location 1 posts a positive profit, **profit1 = 0** when location 1 posts no profit, and **profit1 = -1** when location 1 posts a negative profit. The same holds true for location 2 and its **profit2** variable.

```
data Question3;

numProfits = 0;

do i = 1 to 3;

    u1 = rand("uniform");

    if u1 < ___ then profit1 = -1;
    else if ___ < u1 < ___ then profit1 = 0;
    else if ___ < u1 < 1 then profit1 = 1;

    u2 = rand("uniform");

    if u2 < ___ then profit2 = -1;
    else if ___ < u2 < ___ then profit2 = 0;
    else if ___ < u2 < 1 then profit2 = 1;

    totalProfit = profit1 + profit2;

    if totalProfit > 0 then numProfits = numProfits + 1;

end;
```

Suppose that for the following u1 and u2 values are generated within this simulation:

i	1	2	3	4	5
u1	0.796	0.335	0.663	0.337	0.036
u2	0.729	0.331	0.894	0.102	0.138

Based on these values of u1 and u2 for each of the 5 trials run in the simulation, how many times did location 1 post positive, zero, and negative profits. How many times for location 2? How many times did the two locations post the same type of profit (either both positive, negative, or zero).

(b) For the following SAS code, what initial value of the **sum** variable gives the **sum** variable a final value of 10 once the 3 iterations of the do-loop are complete?

```
sum = _____;

do i = 1 to 3;

    sum = sum + i;

end;
```

Question 4:

Suppose that a cupcake must go through 3 stages before it is finally completed. First, it must be baked, which is normally distributed between 18 and 22 minutes. Then, it must be frosted, where the time is normally distributed with mean 8 minutes and standard deviation 3 minutes. Lastly, it must be boxed up. If the frosting time is less than 5 minutes, it only takes 2 minutes to box up. If the frosting time is between 2 and 6 minutes, it takes 3 minutes to box up. If the frosting time is more than 6 minutes, it takes 4 minutes to box up. Run 1,000 simulation for the total processing times for cupcakes.

1. What is the average processing time?
2. What is the maximum time?
3. What is the minimum time?
4. What's the probability it takes longer than 32 minutes to complete a cupcake?