NAME:____________________

**MATH 1180**
**Midterm III**

Do all three problems, using one page of notes but no calculator.

**1.** A young woman named Sheafe is about to celebrate her 21st birthday, and invites 21 friends to the party. Each friend comes to the party independently with probability 0.7.

- **a.** What is the mean of the party attendance?
- **b.** What is the variance of the party attendance?
- **c.** Write the formula for having exactly 16 friends attend.
- **d.** Write the formula you would evaluate to estimate this with the normal distribution.
- **e.** Which of the answers to **a-d** would remain the same if the friends did not attend independently?
- **f.** **Extra Credit:** To 3 decimal places, what is $\sqrt{3}$? How about $\sqrt{2}$?

| number | value |
|---|---|
| $21 \times 0.3$ | 6.3 |
| $21 \times 0.7$ | 14.7 |
| $21 \times 0.3^2$ | 1.89 |
| $21 \times 0.7^2$ | 10.29 |
| $21 \times 0.3 \times 0.7$ | 4.41 |
| $\sqrt{21 \times 0.3}$ | 2.51 |
| $\sqrt{21 \times 0.7}$ | 3.83 |
| $\sqrt{21 \times 0.3^2}$ | 1.37 |
| $\sqrt{21 \times 0.7^2}$ | 3.21 |
| $\sqrt{21 \times 0.3 \times 0.7}$ | 2.1 |

**2.** Congratulatory phone calls arrive at a rate of 0.6/hour starting at 8:00 a.m. and continue at that rate until midnight.

**a.** What is the approximate probability of no call during 1 minute?

**b.** When is the expected time of the first congratulatory call?

**c.** How many calls would Sheafe expect to miss if she left for 2 hours to go shopping at City Creek Center? What would the variance be?

**d.** What is the probability that she didn't miss any calls while shopping?

**e.** **Extra Credit:** Suppose calls last an average of 5 minutes. About how many people would get busy signals? What assumptions did you have to make?

**3.** Let the random variable $D$ denote how early or late a gift arrives, with $D = -1$ meaning one day early, $D = 0$ meaning right on time, and $D = 1$ meaning one day late. The cost of the gifts is either $C = \$20$ or $C = \$50$, described by the following table.

| | $D = -1$ | $D = 0$ | $D = 1$ | | |
|---|---|---|---|---|---|
| $C = 20$ | ? | 0.4 | ? | $\rightarrow$ | $\Pr(C = 20) = 0.6$ |
| $C = 50$ | ? | ? | 0.15 | $\rightarrow$ | $\Pr(C = 50) = 0.4$ |
| | $\downarrow$ | $\downarrow$ | $\downarrow$ | | |
| | $\Pr(D = -1) = 0.2$ | $\Pr(D = 0) = 0.6$ | $\Pr(D = 1) = 0.2$ | | |

**a.** Fill in the missing values. What is this table called?

**b.** Find the conditional distribution if $C = 20$. What does this tell you about whether the two measurements are independent?

**c.** Is the correlation of $D$ and $C$ positive, negative or zero? Convince me of your answer.

**d.** **Extra Credit:** What year was George Washington born? What year did Thomas Arundel, Archbishop of Canterbury and friend of King Henry IV, die?