

Print Name: _____

Key

Math 127 – Exam 2 – Summer 2017

Version Simon

PROBABILITY PART

Oath: “I will not discuss the exam contents with anyone on planet Earth until the answer key is posted to Blackboard.”

Sign Name: _____

The penalty for cheating on this Exam is a grade of 0% for Math 127 Exam 2.

Student Instructions

1. This test is graded out of 50 points and counts for 10% of your Math 127 grade. There are 33 questions each worth 1.5 points. Question 4d is extra credit for 3 points.
2. You can use a calculator, but you cannot use your phone. You can use the calculator on the computers if you wish.
3. You will need to use www.statcrunch.com. This is the only permitted webpage.
4. You are permitted to use one 8.5” by 11” sheet of notes, front and back. You will submit it with your test.

You may not use the pink sheet or copies of the pink sheet.

You must produce (handwritten or typed up) your own sheet of notes.

You may not use copies or scans of any instructor-created Math 127 content or answer keys.

5. Show work or points will be deducted. If you only report an answer and it is wrong, you will receive no credit.

1. We have a Normal model for "**Song Length**" for the songs played by WKYS in Baltimore, 93.5 FM, Smooth Jazz coming right at you. We know the mean for this model is 304 seconds and we know the standard deviation for this model is 63 seconds.

- 1a. A particular song is 7 minutes = 420 seconds long. Is that song unusually long? Use z-scores to address.

$$z = \frac{420 - 304}{63} = 1.84 \quad \text{technically not unusually long}$$

- 1b. Determine the probability that the next song is over 5 minutes long: 0.5253

- 1c. Determine the probability that the next song is under 4 minutes long: 0.1548

- 1d. The 15th percentile is 238.7 seconds.

2. We have an Exponential model for the "**Time Between Tweets**" from President Donald Trump. We believe the mean to be 12 hours.

- 2a. Determine the probability that the next Tweet comes in the next 10 hours: 0.5654

- 2b. Determine the probability that we don't get a Tweet for at least 2 days: 0.0183

- 2c. The 50th percentile is 8.32 hours. Interpret this value with a sentence in context: _____

Half the time, we get the next
Tweet within 8.32 hours.

Half the time, we wait longer.

3. We have a Uniform model for "**Time it Takes Students to Complete a Math 127 Video Quiz**" with endpoints of 1 minute and 5 minutes.

- 3a. 90% of students finish the video quiz within 4.6 minutes.

- 3b. Determine the probability that a quiz takes longer than 4-and-a-half minutes: 0.125

- 3c. Expected time to finish the video quiz is 3 minutes

4. As of January 2017, iPhones and the iOS operating system has 37.1% of the American market share. Let's presume this figure holds at Cecil College and let's take a sample of size $n = 20$ students. Presume all conditions are met to use a Binomial model.

- 4a. How many students do we expect to have iPhones? $\mu = np = 7.42$
- 4b. $P(\text{A majority have iPhones}) = P(X \geq 11) = 0.0789$
- 4c. $P(\text{At most 3 have iPhones}) = P(X \leq 3) = 0.0294$
- 4d. The 92.106th percentile is! $X = 10$

5. The following table lists the probabilities for "*Number of Children*" for Cecil College students.

"Number of Children"	Probability
0	0.78
1	0.07
2	0.07
3	0.05
4	0.01
5	0.01
6	0.01

- 5a. $P(\text{Random Cecil student has at least 2 kids}) = 0.15$
- 5b. $P(\text{Random Cecil student has at most 3 kids}) = 0.97$
- 5c. Calculate the expected "*Number of Children*" for students here at Cecil College:

$$\mu = 0(0.78) + 1(0.07) + \dots + 6(0.01)$$

$$\mu = 0.51 \text{ Kids}$$

zzz Retired

6. Estimate the following probabilities using our "*Calendar Year 2017 Large Survey*":

- 6a. $P(\text{Cecil student is "On the Fence" for "Global Warming"}) = \frac{77}{502} = 0.2948$
- 6b. $P(\text{Cecil student is "Male" and has "Military" experience}) = \frac{9}{272} = 0.0331$
- 6c. $P(\text{Student is "Married" if we know she is "Female"}) = \frac{33}{184} = 0.1793$

¹ Extra Credit Alert

7. McNugget time. We know McNuggets come in four shapes, all equally likely: Bone, Bell, Ball, and Boot.

Use a Binomial distribution to determine if your 20-Piece Nugget has at least 5 Boots.

$$n = 20 \\ p = 0.25 \quad P(X \geq 5) = 0.5852$$

8. When played with regulation rules, a random game of *Uncle Web Knows Best* will have a "Duration" in minutes following a $N(33, 10)$ probability model.

During family-fun-night, 4 games are played. Determine the probability that all four games last at least half an hour.

$$P(\text{any game exceeds 30 minutes}) = 0.6179$$

$$P(4 \text{ for } 4 \text{ exceed 30 mins}) = (0.6179)^4 = 0.1458$$

9. The day class has $n = 19$ active students. If we believe $P(\text{Day Student Shows Up}) = 0.91$ for each student, determine the probability that we have perfect attendance for a random class. We must presume students act independently.

$$P(19 \text{ for } 19 \text{ show up}) = (0.91)^{19} \\ = 0.1666$$

10. The night class has $n = 14$ active students. If we believe $P(\text{Night Student Shows Up}) = 0.89$ for each student, determine the probability that we have at least one absence for a random class. Presume students act independently.

$$P(\text{at least one absence}) = \\ 1 - P(\text{all 14 show up}) = \\ 1 - (0.89)^{14} = 0.8044$$

11. Here is a contingency table generated from our survey data:

Contingency table results:

Rows: Recreational Drugs

Columns: Instructor

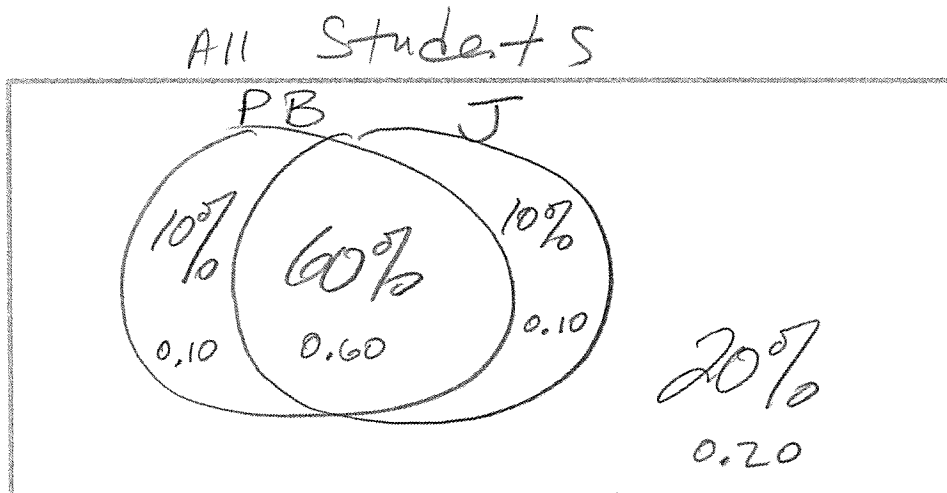
	Drach	Kupresanin	Sheppard	Total
No, Never	27	85	76	188
Yes, Occasionally	18	21	13	52
Yes, Regularly	6	11	5	22
Total	51	117	94	262

Presume these figures are in line with our entire school.

- 11a. Estimate $P(\text{Does Drugs} \mid \text{Drach's students}) = \frac{24}{51} = 0.4706$
 Estimate $P(\text{Does Drugs} \mid \text{Kupe's students}) = \frac{32}{117} = 0.2735$
 Estimate $P(\text{Does Drugs} \mid \text{Sheppard's students}) = \frac{18}{94} = 0.1915$
 11b. Estimate $P(\text{Random Student Does Drugs}) = \frac{74}{262} = 0.2824$

12. We know that 70% of students like "*Peanut Butter*", 70% of students like "*Jelly*", and 60% of students like both.

12a. Draw a well-labeled Venn diagram:

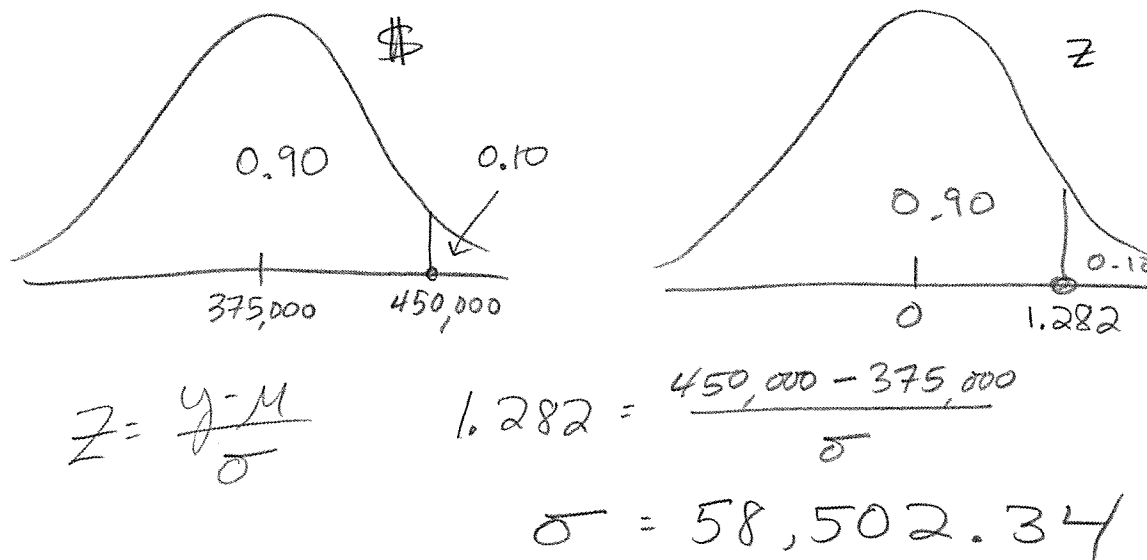


- 12b. $P(\text{Like "Peanut Butter" or "Jelly"}) = 0.80$
 12c. $P(\text{Like "Peanut Butter"} \mid \text{like "Jelly"}) = \frac{0.60}{0.70} = 0.8571$
 12d. $P(\text{Like "Peanut Butter"} \mid \text{don't like "Jelly"}) = \frac{0.10}{0.30} = 0.3333$

13. "Home Prices" in the 21204 have a mean of \$375,000 with a standard deviation of _____.

Some legwork on Zillow reveals that 10% of homes cost \$450,000 or more.

Show the work and solve for the missing standard deviation:



14. If Cecil College males have "Heights" that follow a Normal model with a mean of 70 inches and a standard deviation of 3 inches, determine the probability that in a class with five random dudes, all five are of above average "Height".

Since Normal, $P(\text{Above Avg}) = 0.50$

$$P(5 \text{ for } 5 \text{ above Avg}) = (0.50)^5$$

$$= 0.03125$$

15. If "Gender" and "Are You a Business Major" are independent, then

$$P(\text{Yes} | \text{Male}) \underline{=} P(\text{Yes} | \text{Female})$$

Put only correct symbol on the blank line: + - × ÷ ≠



16. Give the 77th percentile if we decide to generate uniformly distributed random numbers on the real number line on the interval from -7 up to +10.

$$P_{77} = \underline{6.09}$$