

Name: Key

Math 127 – Exam 2 – Fall 2016

Oath: *"I will not discuss the exam contents with anyone on planet Earth until it is returned to me by my instructor".*

Sign Name: _____

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

VERSION CLINTON

Testing Center Staff Instructions

1. One sheet of handwritten or typed notes is OK.

Students may not use the "pink sheet" or any copied or scanned answer keys or Math 127 department documents.

2. Collect the sheet of notes and staple it to the test when submitted.
3. Any calculator is OK. No cell phone calculators.
4. www.statcrunch.com is required. All other webpages are prohibited.
5. Test must be completed in one sitting, but it is untimed. Very short bathroom breaks are permitted.

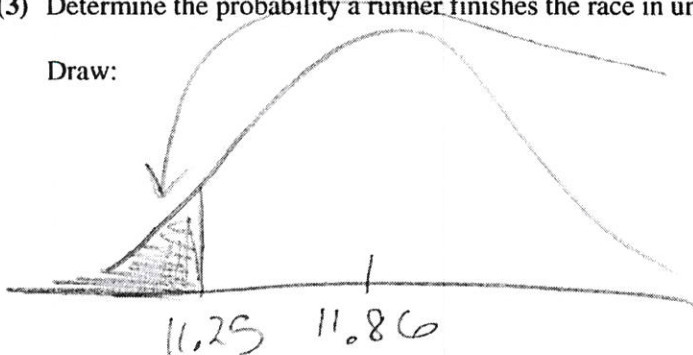
Student Instructions

1. This test is graded out of 100 points and counts for 20% of your Math 127 grade.
2. Show work when necessary or points will be deducted. If you only report an answer and it is wrong, you will receive no credit. You may use the StatCrunch calculators for any probability calculations when appropriate.
3. Points are in parentheses for each question.
4. Good luck, do your best.

1. **New Problem.** For the Over-50 Men's Division, the time to finish a 100-meter race follows a Normal model with a mean time of 11.86 seconds and a standard deviation of $\frac{1}{2}$ a second.

1a. (3) Determine the probability a runner finishes the race in under 11.25 seconds: 0.1112

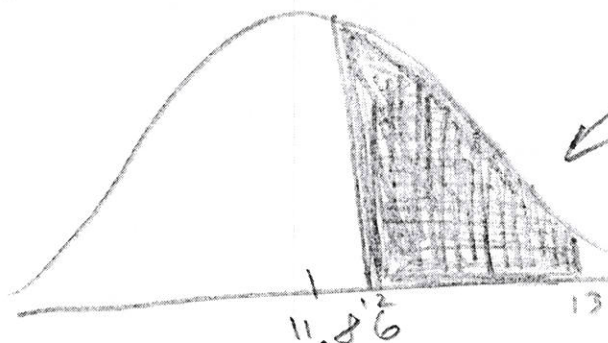
Draw:



$$P(X < 11.25) = 0.1112$$

1b. (3) What proportion of runners finish the race between 12 and 13 seconds? 0.3874

Draw:



$$P(12 < X < 13) = 0.3784$$

1c. (3) The 2nd percentile is 10.83. This means 2% of runners finish within 10.83 seconds and 98% take longer.

1d. (3) A runner finished the race and his z-score was 3. His race time was 13.36 sec.

Show calculation:

$$Z = \frac{y - \mu}{\sigma}$$

$$3 = \frac{y - 11.86}{0.5}$$

$$y = 11.86 + 3(0.5)$$

$$y = 13.36$$

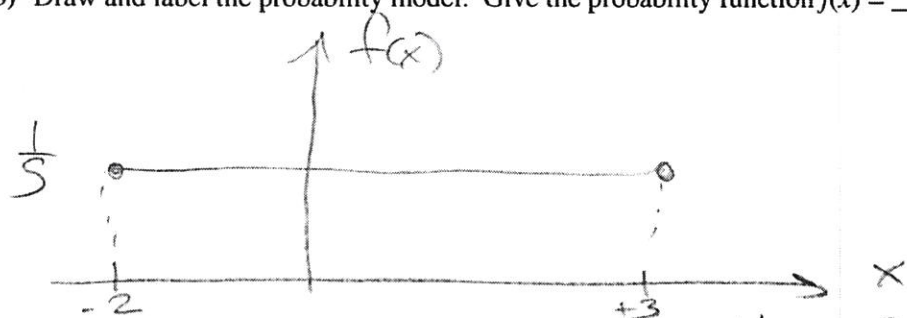
1e. (1) The central 50% of runners finish the race between 11.52 seconds and 12.20 seconds.

1f. (1) The worst 10% of runners take at least 12.50 seconds to finish the race.

1g. (1) The probability that an over-50 runner breaks the World Record time of 9.58 seconds is 0.0000026.

2. **New Problem.** We will program a computer to spit out random real numbers on the interval $[-2, +3]$. All numbers are equally likely so the correct model is the Uniform model.

2a. (3) Draw and label the probability model. Give the probability function $f(x) = \frac{1}{5}, -2 \leq x \leq 3$



2b. (1) $P(\text{Computer spits out a positive number}) = \frac{3/5}{1} = 0.60$

2c. (1) $P(\text{Computer spits out a negative number}) = \frac{2/5}{1} = 0.40$

2d. (1) $P(\text{Computer spits out } 0) = 0$

2e. (3) $P(\text{Computer spits out six positive numbers in a row}) = 0.0467$

Calculation: $P(6 \text{ for } 6 \text{ positive}) = (0.60)^6 = 0.0467$

2f. (3) The mean of this probability model is 0.5 . Calculation: $\mu = \frac{-2+3}{2} = 0.5$

3. **New Problem.** iPhones have a mean lifetime of 3 years. Let's suppose iPhone lifetimes follow an Exponential model. Presume 12 months in a year and that we just divide a year up into 12 equal chunks.

3a. (1) $P(\text{Random iPhone lasts at least 5 years}) = 0.1889$

3b. (1) $P(\text{Random iPhone dies within the first year}) = 0.2835$

3c. (1) $P(\text{Random iPhone dies within the first month}) = 0.0274$

3d. (1) The best 1% of iPhones last at least 13.82 years.

3e. (1) The worst 10% of iPhones die within the first 0.316 years.

- 3f. (3) Kourtney, Kim, Khloe, Kendall, and Kylie all get new iPhones. Presuming independence, what is the probability that all five iPhones last at least one year? Show calculation:

$$P(5 \text{ for } 5 \text{ last one year } +) = (0.7165)^5 = 0.1888$$

4. **New Problem.** At Cecil, $p = 13.21\%$ of our students smoke. In a class of $n = 9$ students, use the Binomial model to address the following questions.

4a. (2) How many students in the class do we expect to be smokers?

$$\mu = np = 9(0.1321) = 1.1889 \text{ students}$$

4b. (2) Determine the standard deviation for the number of smokers in the class.

$$\sigma = \sqrt{np(1-p)} = \sqrt{9(0.1321)(1-0.1321)} = 1.016$$

4c. (2) Yes or no. Would it be unusual to have a class that had 4 smokers? Justify for full credit.

$$\text{Cutpoint } \mu + 2\sigma = 1.1889 + 2(1.016)$$

$$= 3.2209$$

Yes, 4 is unusual.

4d. (1) $P(\text{No one smokes}) = 0.2794$

4e. (1) $P(\text{Everyone smokes}) = 0.00000001$

4f. (1) $P(\text{At least two people smoke}) = 0.3379$

5. **New Problem.** The following table lists salaries for a large company's IT Department:

Salary	\$50,000	\$60,000	\$75,000	\$90,000	\$125,000	\$150,000	\$200,000
Probability	0.71	0.10	0.08	0.05	0.03	0.02	0.01

5a. (1) $P(\text{Random IT employee makes over } \$100,000) = 0.04$

5b. (1) $P(\text{Random IT employee makes at least } \$70,000) = 0.19$

5c. (1) $P(\text{Two random employees both make } \$50,000) = (0.71)^2 = 0.5041$

5d. (3) Expected salary in this department: \$ 60,750

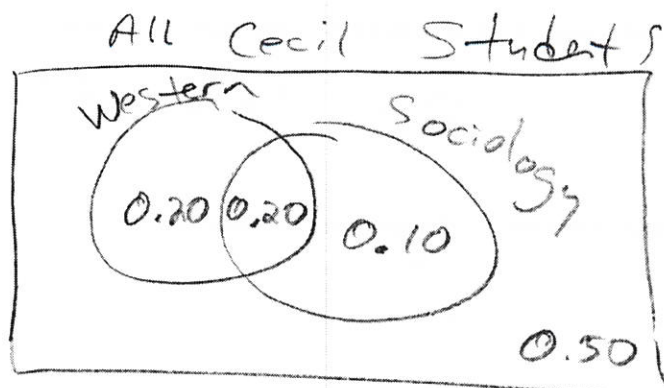
Show calculation:

$$\mu = 50000(0.71) + \dots + (200,000)(0.01)$$

$$\mu = 60,750$$

6. **New Problem.** Draw the Venn Diagram for the following facts: 40% of Cecil students have taken Western Civilization I, 30% have taken Intro to Sociology, and 20% have taken both courses.

6a. (3) Draw and label the Venn Diagram:



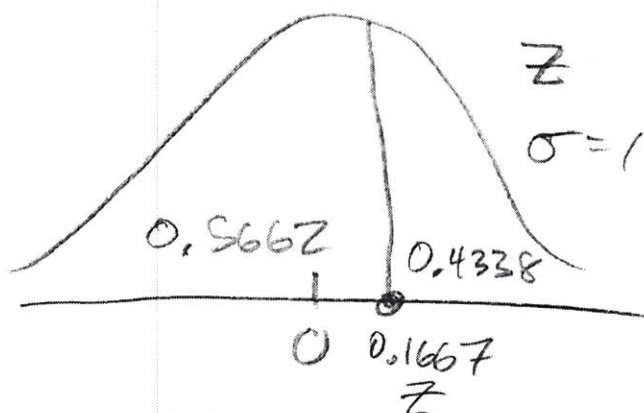
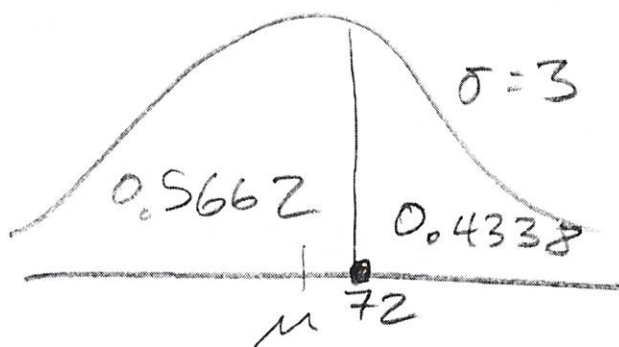
6b. (1) $P(\text{Taken Western Civ} | \text{Intro Sociology}) = \frac{P(\text{Both})}{P(\text{Soc})} = \frac{0.20}{0.30} = 0.6667$

6c. (1) $P(\text{Taken Western Civ} | \text{Not Taken Intro Sociology}) = \frac{P(\text{West AND not Soc})}{P(\text{Not Soc})} = \frac{0.20}{0.70}$

6d. (1) $P(\text{Taken Sociology} | \text{Taken Western Civ}) = \frac{P(\text{Both})}{P(\text{West})} = \frac{0.20}{0.40} = 0.50 = 0.2857$

6e. (1) $P(\text{Taken Sociology} | \text{Not Taken Western Civ}) = \frac{P(\text{Soc. + Not West})}{P(\text{Not West})} = \frac{0.10}{0.60} = 0.1667$

7. (3) **New Problem.** The mean height of men in Baltimore is unknown but we believe the standard deviation to be 3 inches. A survey completed revealed that 43.38% of men were over 6 foot tall (72 inches). Show the work to determine the mean height, presuming the heights follow a Normal model.



$$\mu = 72 - 0.1667(3)$$

$$\mu = 71.50''$$

~~SEE VERSION TRUMP~~

8f. (4) Show the calculation to predict the "Supermarket Price" of "Cherry Coke 2 liter" (it's in row 15).

$$\hat{S}_M = -0.08 + 1.21(1.50) \\ \approx \$1.73$$

8g. (4) Show the calculation for the residual for "Oscar Meyer Sliced Bacon 16 oz" (it's in row 90).

$$e = y - \hat{y} \\ 1.05 = 6.99 - 5.94$$

← plug in $x = 4.98$ to regr. eq.

8h. (4) Interpret with a sentence the residual for "Honey Nut Cheerios Oats 12.25 oz" in row 59.

This cereal is \$2.02 more expensive
~~at~~ at the Supermarket than we'd
expect for its Walmart Price of \$3.13.

8i. (2.5) Make a list of the product names that have large positive residuals. There are five.

1. Strawberry Nesquik
2. Donut Shop K Cup S
3. Chips Ahoy Cho-Chip
4. Honey Nut Cheerios Oats
5. Hormel Black label

Are these products "good buys" or "crappy buys" at the "Supermarket"? Bad Buys

8j. (1.5) Make a list of the product names that have large negative residuals. There are three.

1. Silk Almond Milk
2. T&F Honey BBQ ...
3. Gallon of milk

Are these products "good buys" or "crappy buys" at the "Supermarket"? Good

8k. (2) Calculate the cutoff value for a large Cook's distance:

$$4/28 = 0.63125$$

7

8l. (2) How many products in the dataset have a large Cook's distance? 7

~~SEE VERSION TRUMP~~

Retired -

8. **New Problem.** Use the "Calendar Year 2016 Grocery Prices" dataset to run this regression analysis. We had students go to Wal Mart and a supermarket to get the price of a food item at both stores.

8a. (2) Use the entire dataset. Determine the linear regression equation to predict "Supermarket Price" based on the "Wal Mart Price".

Equation: $\hat{SMP} = -0.08 + 1.21(WMP)$

8b. (4) Describe the relationship between "Wal Mart Price" and "Supermarket Price". Bullet points OK. You can eyeball the outliers for this step, but give any relevant details.

Form: Linear Direction: Positive

Strength: Very Strong, $r = 0.965$

Outliers: Clearly 36 count of K-Cups!

8b. (4) Interpret the slope with a sentence in context: As Walmart increases prices by \$1.00, we expect the Supermarkets to raise prices by \$1.21.

8c. (2) The y-intercept is (\$0 at Wal Mart, -\$0.08 at the Supermarket). Explain why this point on the line is sort of meaningless.

Nothing costs \$0 at WM!

Nothing costs -8¢ at SM! Duh!

8d. (4) Interpret the value of R^2 with a sentence in context: 93.08% of the variation in SM price is explained by knowing WM price. 6.92% is still unexplained.

8e. (4) Interpret the value of S_e with a sentence in context: On average our predicted SM prices are off by 7.3¢ when using $X = WM$ price.