Name: Key **Math 127 – Test 2A – Fall 2015**

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

**Sign Name:** Key

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

## 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

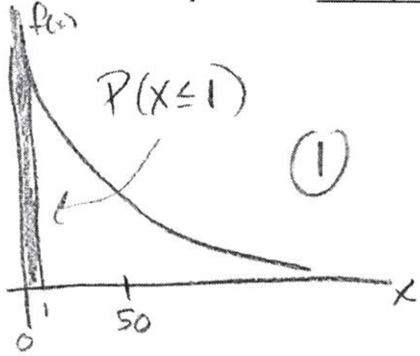
1. This test is graded out of 100 points and counts for 20% of your Math 127 grade.

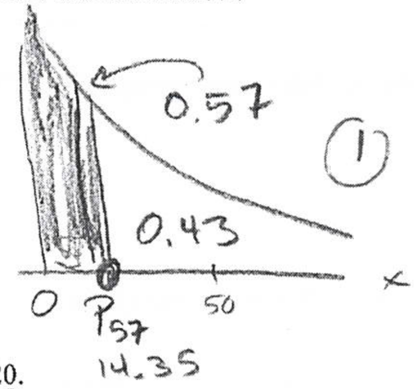
2. Show work or points will be deducted. If you only report an answer and it is wrong, you will receive no credit.

**1.** We have an **Exponential** model with a mean of 17.

**1a.** Give P(*X* is at most 1) = 0.0571 (2). Draw and label below.

**1b.** Give the $57^{th}$ percentile: 14.35 (2). Draw and label below.




**2.** We have a **Binomial** model with $n = 12$ and $p = 0.20$.

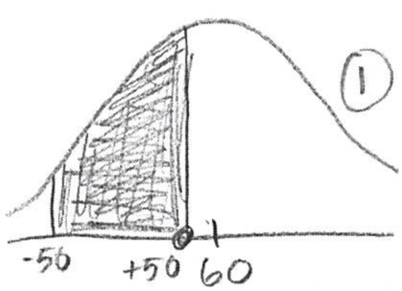
**2a.** Give P(at least 2 successes) = 0.7251 (2).

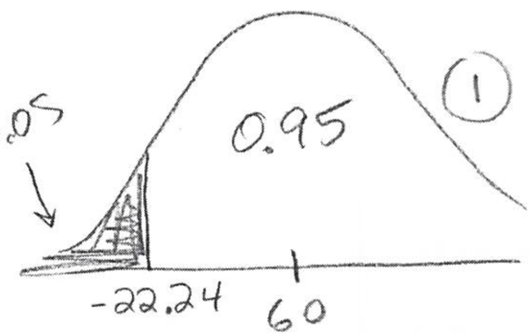
**2b.** Extra Credit (2 points). Give the closest approximation to the $80^{th}$ percentile: X = 3 $\boxed{+2}$

**3.** We have a **Normal** model with $\mu = 60$ and $\sigma = 50$.

**3a.** Give P(*X* is between –50 and +50) = 0.4068 (2). Draw and label below.

**3b.** Give $5^{th}$ percentile: –22.24 (2). Draw and label below.

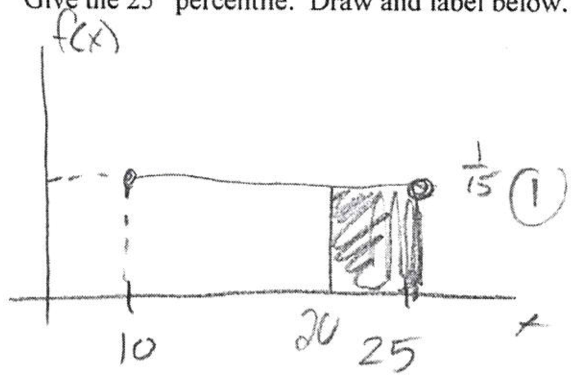



**4.** We have a Uniform model on the interval [10, 25].

**4a.** Give P(X > 20) = 1/3 = 0.3333 (2). Draw and label below. $L \times H = 5 \times \frac{1}{15} = \frac{5}{15} = \frac{1}{3}$

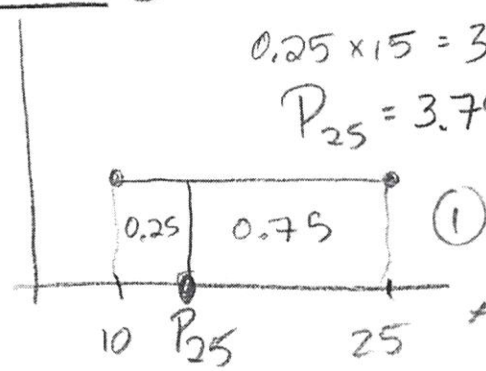
**4b.** Give the $25^{th}$ percentile. Draw and label below. $P_{25} = 13.75$ (2)




$0.25 \times 15 = 3.75$

$P_{25} = 3.75 + 10$

$= 13.75$



**5.** An actuary for an insurance company created the following probability table for a certain home insurance policy for a home in Minneapolis, MN.

| Event | Payout to Policy Holder | Probability |
|---|---|---|
| No claim | $0 | 0.9218 |
| Minor claim | $5000 | 0.0644 |
| Medium claim | $25,000 | 0.0092 |
| Major Claim | $400,000 | 0.0046 |

**5a.** Presuming years are independent, determine the probability that over the course of 30 years, the policy holder is paid some money at least once. Show calculation.

P(Paid at least once) =

1 − P(not paid at all in 30 years) =

$1-(0.9218)^{30} = 0.9131$ (2)

**5b.** Determine the expected payout each year. Show calculation.

$\mu = \sum x P(x) = 0(0.9218) + 5000(0.0644) + 25000(0.0092) + 400{,}000(0.0046)$

$= \$2392$ (2)

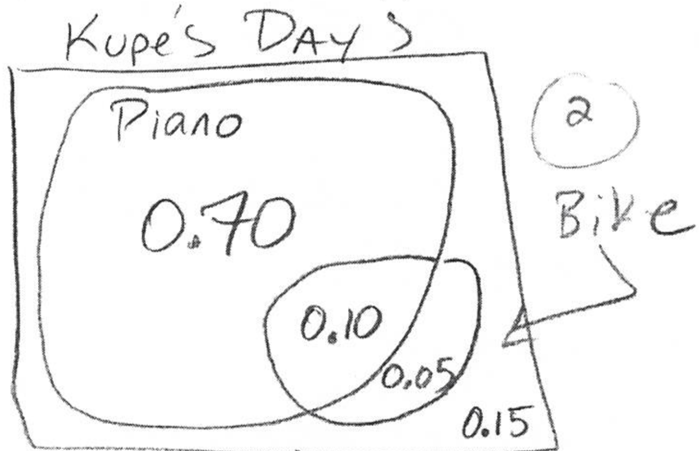
**5c.** Show calculation. P(Medium claim two years in a row) =

$P(2 \text{ for } 2 \text{ medium}) = (0.0092)^2$

$= 8.464 \times 10^{-5}$

$= 0.00008464$ (2)

**6.a)** Draw the Venn diagram and label everything properly. On 80% of days, Professor Kupe plays piano. On 15% of days he rides his mountain bike. On 10% of days, he does both.

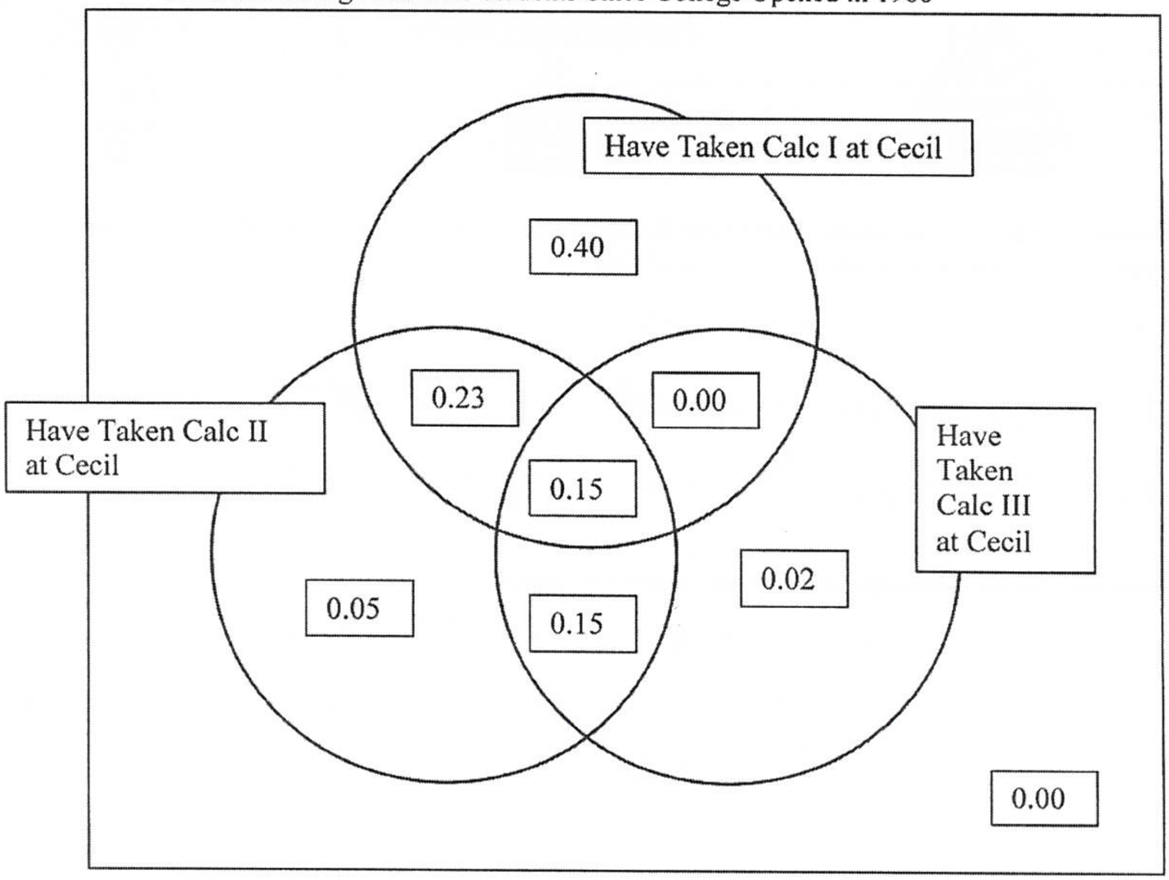



(2)

6b.) P(neither) = 0.15 (2)

**7.** Use the Venn Diagram to answer questions **7a – 7c**.

All Cecil College Calculus Students Since College Opened in 1968




**7a.** Determine the probability that three random students have all taken Calc II at Cecil. Show calculation.

$P(\text{Calc II}) = 0.05 + 0.23 + 0.15 + 0.15 = 0.58$

$P(3 \text{ for } 3 \text{ taken Calc II}) = (0.58)^3 = 0.1951$ 2

**7b.** Determine the probability that a student has taken Calc II and Calc III .

$P(\text{Calc II \& III}) = 0.15 + 0.15 = 0.30$ 2

**7c.** P(Calc II | Calc I) = $\dfrac{P(\text{Both Calc I and II})}{P(\text{Calc I})}$

$= \dfrac{0.23 + 0.15}{0.23 + 0.15 + 0.40 + 0.00} = \dfrac{0.38}{0.78}$ 2

$= 0.4872$

**8.** ***Midnight White*** paint has blue dye added to it by the Home Depot associate. The amount of blue dye follows a N(5 ml, 0.03 ml) model.

You buy 10 cans to paint your solarium. What's the probability that all 10 cans fall within two standard deviations of the mean of 5 ml of blue? Show calculation.

$\pm 2$ SD is 4.94 to 5.06

$P(4.94 \le x \le 5.06) = 0.9545$ (2)

$P(\text{10 for 10 in here}) = (0.9545)^{10} = 0.6277$

**9.** For a typical Math 127 class with $n = 30$ students, suppose each student has a $p = 0.95$ probability of attending on any random day.

**9a.** P(Perfect attendance) = $P(X=30) = 0.2146$ (2)

**9b.** P(At least 28 students show up) = $P(X \ge 28) = 0.8122$ (2)

**9c.** Explain why it is inappropriate to use the Normal approximation for the Binomial model for this problem:

Either OK

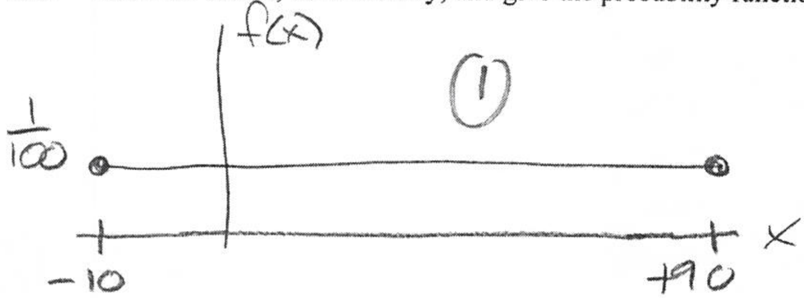
(1) $n(1-p) = 30(0.05) = 1.5$ does not exceed 10 (1)

(2)

(2) Shape of Binomial model not Symmetric. (1)

**10.** We will program a computer to spit out completely random numbers on the real number line from –10 to +90. Since all real numbers are equally likely, a Uniform model is appropriate.

**10a.** Draw the model, label entirely, and give the probability function $f(x)$ = $\frac{1}{100}$, $-10 \le x \le 90$ (1) (2).




(2)

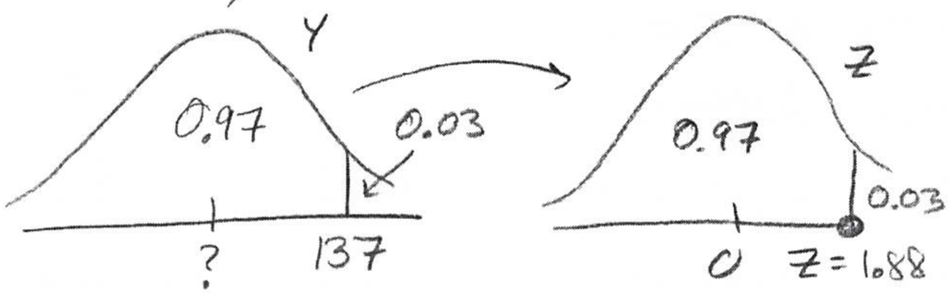
**10b.** Determine the P(computer spits out a negative number) = $L \times H = 10 \times \frac{1}{100} = \frac{1}{10} = 0.10$

**10c.** Calculate the mean for this probability model. Show calculation.

$\mu = \frac{a+b}{2} = \frac{-10+90}{2} = \frac{80}{2} = 40$ (2)

**11.** We will model IQ scores for Harvard students with a Normal model. We will assume the standard deviation is 15 but don't know the mean. From some actual IQ tests we found, it is learned that 3% of the test takers had an IQ score of 137 or above. Determine the mean IQ score at Harvard. Show calculation.

$\sigma = 15 \quad \mu = ?$



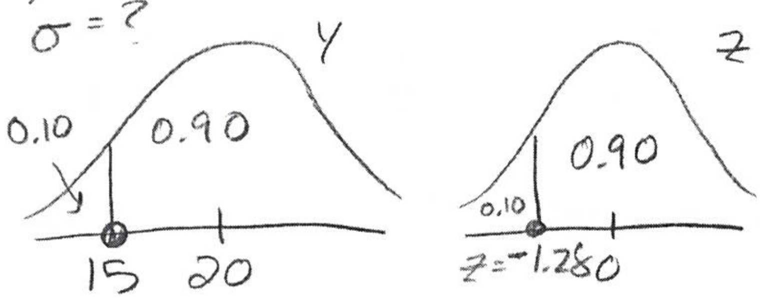

$$z = \frac{y-\mu}{\sigma}$$

$$1.88 = \frac{137-\mu}{15}$$ (2)

$$\boxed{\mu = 108.8}$$

**12.** A jogger feels confident he averages 20 miles each week but hasn't a clue on the standard deviation for his miles. He checks his records and determines that for 10% of the weeks, he jogged 15 miles or less. Assuming a Normal model applies, calculate his standard deviation for mileage. Show calculation.

$\mu = 20$
$\sigma = ?$




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

$$-1.28 = \frac{15-20}{\sigma}$$

$$\boxed{\sigma = 3.91}$$ (2)

**13.** Use the contingency table generated from our "**Calendar Year 2015 Large Survey**" to answer question **13**.

**Contingency table results:** Rows: Instagram Columns: Facebook

| | All the time | Never | Rarely | Sometimes | Total |
|---|---|---|---|---|---|
| All the time | 17.82% | 5.14% | 6.65% | 8.76% | 38.37% |
| Never | 7.85% | 10.27% | 7.55% | 6.34% | 32.02% |
| Rarely | 3.63% | 1.21% | 0.91% | 3.32% | 9.06% |
| Sometimes | 5.44% | 3.63% | 3.93% | 7.55% | 20.54% |
| Total | 34.74% | 20.24% | 19.03% | 25.98% | 100% |

(2)

**13a.** P(Rarely Use Instagram | Rarely Use Facebook) = $\frac{P(\text{Rarely Rarely})}{P(\text{Rarely FB})} = \frac{0.91\%}{19.03\%} = 0.0478 = 4.78\%$

**13b.** P(Three random students all use Facebook all the time) = 0.0419 (2)

P(FB all the time) = 0.3474

P(3 for 3 FB all) = $(0.3474)^3$

"ZZZ - Retired"

**14.** The big regression problem. Use the "**Calendar Year 2015 Grocery Prices**" dataset. We will be predicting the "***Supermarket Price***" based on $x$ = "***Wal-Mart Price***".

**14a.** First things first. Check the scatterplot. The 2 Liter of Coker and the Snickers bar have to come out, clearly those were typos. Remove them for this entire problem. Once they're out, you should have $n = 124$ data points with a mean "***Wal-Mart Price***" of \$3.34 and a mean "***Supermarket Price***" of \$3.94.

**14b.** Pretend we work for Food Lion, **so all we care about are the Food Lion data points**. There are 40 of them left after removing the Coker and the Snickers.

**14c.** Create your scatterplot **for Food Lion only**, using the Where Box, Where Supermarket = "***Food Lion***".

**14d.** Run your linear regression **for Food Lion only**, using the Where Box, Where Supermarket = "***Food Lion***". Save your residuals, Studentized residuals, and Cook's. If you did this correctly, the $y$-intercept should be 0.73264531.

Alright, answer the following questions. **Everything is for Food Lion data only**!

**14e.** Form: Linear (1) Direction: Positive (1) Measure of Strength: r = 0.848 (1)

**14f.** Interpret the slope with a sentence in the context of the problem. Include all units.

Based on our data, for every extra one dollar Wal-Mart increases prices, we expect Food Lion to raise them by \$0.95 (4)

**14g.** Why is the $y$-intercept of \$0.73 not an interpretable value? There are two reasons. Give them both.

1. No data by X = \$0.00 for Walmart (2)
2. X = \$0 at Walmart is nonsense. Nothing is free (2)

**14h.** A product for \$3.39 at Wal-Mart is predicted to cost \$ 3.94 at Food Lion. (4)

**14i.** "***Naked Mighty Mango***" has a residual of –\$0.75. Interpret the residual with a sentence in context.

This product was \$0.75 cheaper than predicted at Food Lion, based on its \$4.77 Wal-Mart Price. (4)

**14j.** Interpret the value of $S_e$ with a sentence in the context of the problem:

Our predicted Food Lion prices are off by \$0.67 when using X = Wal-Mart price. (4)

**14k.** Interpret the value of $R^2$ with a sentence in the context of the problem:

$R^2$ = 71.84% of the variation in Food Lion prices can be explained by knowing the Wal-Mart price. (4)

**14l.** Only one product has an unusually large positive or negative Studentized residual.

Which product? Snack Pack Chocolate Pudding (1)

Actual residual: \$1.99 (1)

Studentized residual: 3.00 (1)

**14m.** Two products have unusually large Cook's distances:

Product 1: Snack Pack (1) Cook's: 0.126 (1)

Product 2: 30 oz Maxwell House (1) Cook's: 0.505 (1)

**14n.** The Cheerios in row 19 have a residual of \$0.43. Verify below the calculation to arrive at this residual.

$e = y - \hat{y}$

= Actual Food Lion Price − Predicted Food Lion Price

= 3.98 − 3.55 = \$0.43 (4)

14o. Give a range of Wal-mart prices for which you would be comfortable predicting Food Lion prices: 0.58 to 6.74

(4)