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

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

Sign Name: ______________________________

1. The Testing Center will issue you a TI-84 calculator. This is the only calculator permitted in the Cecil College Testing Center.

2. You will need to use www.statcrunch.com. This is the **only** permitted webpage.

3. You are permitted to use one 8.5" by 11" sheet of notes, front and back that will be collected 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.

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

Initial Below!

5. Report all **probabilities** as decimals rounded properly to four places. Initial: ____________

   Example: 0.12367009 on your calculator is 0.1237

6. Report all **percentages** rounded properly to the hundredths place. Initial: ____________

   Example: 0.4555553 on your calculator is 45.56%

Point Values:

7. This test is weighted 60% probability, and 40% regression.

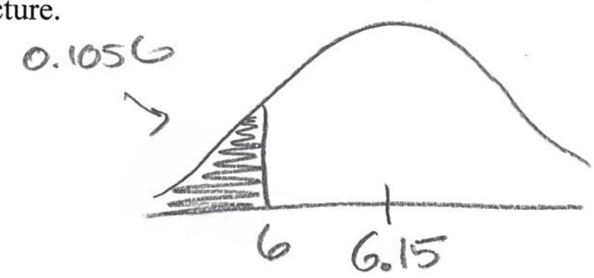
8. All questions on numbers 1 – 10 are worth 2 points each.

9. All questions on number 11 are worth 4 points each.

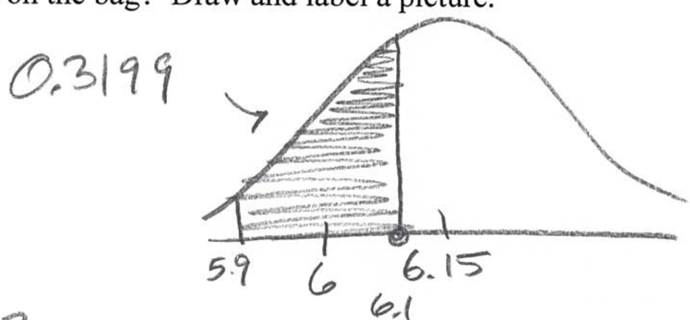
Questions 1 – 10: Probability, 2 points each.

1. Suppose 6 ounce bags of pretzels actually follow a $N(6.15\text{oz}, 0.12\text{oz})$ distribution (even though the bag of pretzels advertises its weight is 6oz.) For this entire problem assume the bags of pretzels are labeled as 6 oz but actually follow $N(6.15\text{oz}, 0.12\text{oz})$.

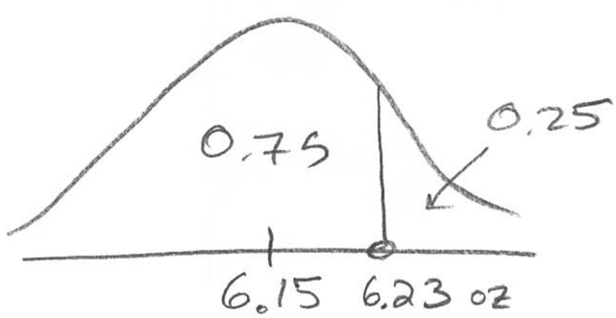
1a. 10.56% What percentage of bags of pretzels are actually under 6 ounces? Draw and label a picture.



1b. 0.3199 What is the probability that your bag of pretzels is within 0.10 ounces of what is printed on the bag? Draw and label a picture.



1c. 6.23oz Determine Q_3 for the ounces in a bag of pretzels. Draw and label a picture.



1d. 0.7155 If you buy 3 bags of pretzels, determine the probability that all 3 are over 6 ounces heavy. **Show calculation.**

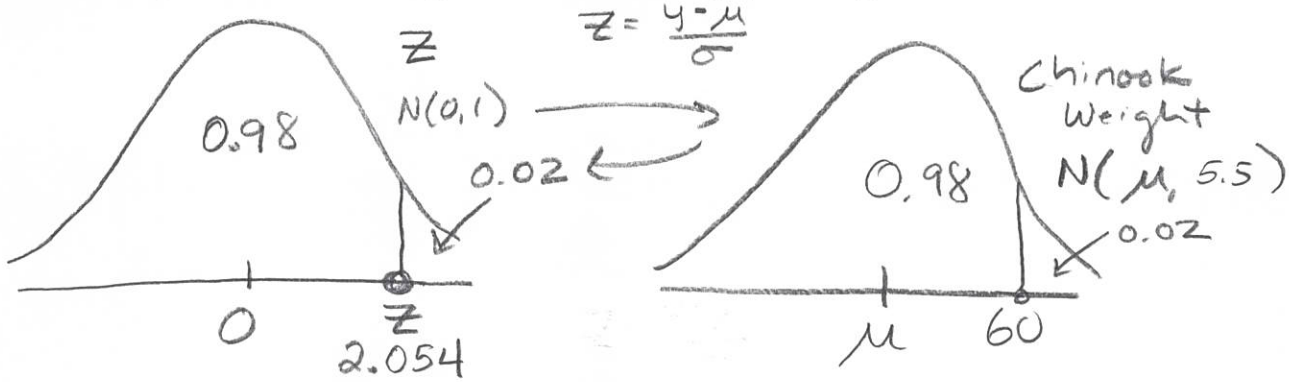
P(Over 6 oz) = 1 − 0.1056 = 0.8944

P(3 for 3 over 6 oz) = $(0.8944)^3$

= 0.7155

2. The weight (in kilograms) of the Chinook salmon follows a Normal model, but suppose the mean weight is unknown. We do know that the standard deviation is 5.5 kg and only 2% of this species have weights that exceed 60 kg. Find the mean weight, showing all work below.

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

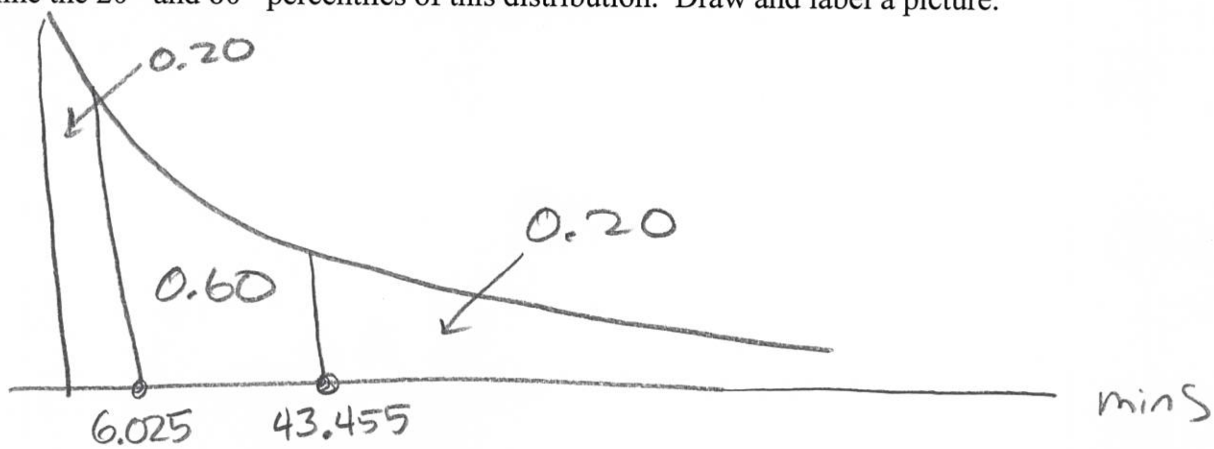


$Z = \frac{y-\mu}{\sigma} \rightarrow 2.054 = \frac{60-\mu}{5.5} \rightarrow \mu = 60 - 2.054(5.5)$

$\boxed{\mu = 48.703 \text{ kg}}$

3. The time between 911 calls in a certain county follows an Exponential distribution with a mean of 27 minutes.

3a. Determine the 20th and 80th percentiles of this distribution. Draw and label a picture.



3b. Find P(Next call within the next 15 minutes): 0.4262

$P(X \le 15)$

3c. Presume calls are independent of each other. Determine the probability that it's at least an hour until the next call, and then at least another hour until the call after that. Show calculation.

P(Any call at least 60 mins) = $P(X \geq 60)$

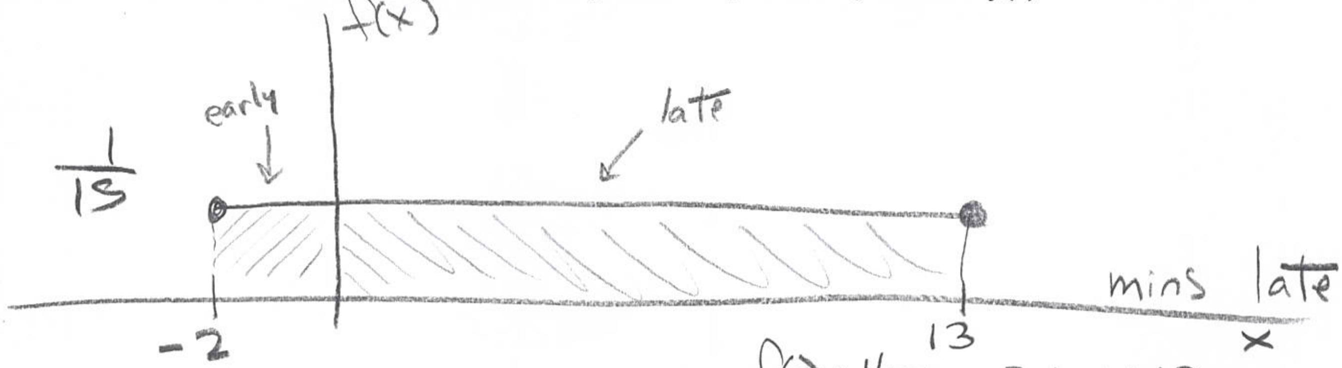
$= 0.1084$

P(2 for 2 at least 60 mins) =

$(0.1084)^2 = 0.0118$.

4. Suppose a certain Southwest Airlines flight to Cleveland follows a **Uniform** [–2, 13] distribution. Here $X = -2$ corresponds to the flight leaving 2 minutes early and $X = 13$ corresponds to the flight leaving 13 minutes late. $X = 0$ corresponds to the flight leaving exactly on time.

4a. Draw the probability distribution graph and clearly state the probability function $f(x)$:



$f(x)$ = $f(x) = 1/15, \; -2 \le x \le 13$

4b. P(Flight leaves early) = $2/15 \approx 0.1333$

4c. P(Flight leaves late) = $13/15 \approx 0.8667$

4d. Presume this flight leaves every day of the week, and that days are independent of each other. Determine the probability that in the next seven days, at least one flight leaves early. Show calculation.

P(at least one in seven is early) =

1 − P(all 7 are late) =

$1 - (0.8667)^7 = 0.6326$

4e. What is the expected departure time? Show calculation.

$\mu = \frac{a+b}{2} = \frac{-2+13}{2} = 5.5$ mins late

4f. What is the 10^{th} percentile of this distribution? Show calculation.

$0.10 \times 15 = 1.5$

10^{th} Percentile $= -2 + 1.5 = -0.5$ mins

5. Use the following table to answer the following questions. Give **fractions** followed by the **decimal** answers rounded to **four decimals** if appropriate.

Contingency table results:
Rows: Smoker
Columns: Exercise

	Never	Rarely	Monthly	Weekly	Daily	Total
No	30	87	86	42	8	253
Yes	19	21	6	7	0	53
Total	49	108	92	49	8	306

5a. Complete the contingency table. This does not correspond to a StatCrunch dataset, so don't bother looking.

If we randomly select one student, find:

5b. *P*(Monthly | Nonsmoker) = $86/253 = 0.3399$

5c. P(Weekly AND Smoker) = $7/306 = 0.0229$

5d. P(Never OR Smoker) = $83/306 = 0.2712$

5e. P(Nonsmoker | Rarely) = $87/108 = 0.8056$

4/5 don't win

6. Your McDonald's is running a contest on McMuffins. "***1 in 5 wins***" it says.

To be nice, you buy your whole 8:00 English 101 class of $n = 13$ students a McMuffin, with the express agreement that if anyone wins, it's your prize.

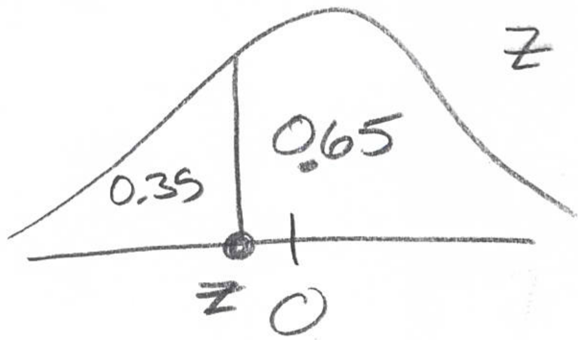
Determine the probability that you win at least one time. Show calculation.

P(win at least once) =

1 − P(never win) =

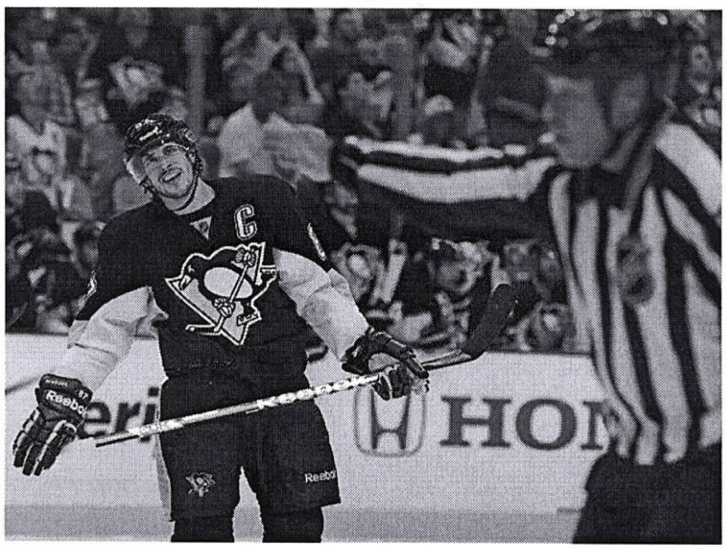
$1 - (4/5)^{13} = 0.945$

7. Give the z-score that corresponds to the 35th percentile for a Standard Normal model. Draw and label a picture.



$z = -0.3853$

8. Professor Kupe's least favorite hockey player of all time is Sydney Crosby. Suppose the following table estimates the probabilities for the "***Number of Goals***" scored each game.



Goals	**0**	**1**	**2**	**3**	**4**	**5**
Probability	**0.56**	**0.39**	**0.03**	**0.01**	**0.006**	**0.004**

8a. P(At most one goal) = $0.56 + 0.39 = 0.95$

8b. For any given game, how many goals do we expect Crosby to score? Show calculation.

$$\mu = 0(0.56) + 1(0.39) + 2(0.03) + 3(0.01) + 4(0.006) + 5(0.004) =$$

$$= 0.524 \text{ goals}$$

9. Suppose Cecil College faculty salaries follow a Normal model with a mean \$62,000 and a standard deviation of \$6,200. Give the boundaries for salary that would capture the central 95% of all faculty.

$\mu \pm 2\sigma \rightarrow$ (\$49,600 to \$74,400)

OR use Normal calculator

(\$49,848 to \$74,152)

10. A male is going to try online dating, and it is established that only 6% of male-written emails sent to females garner a response. Suppose this guy is going to write 20 emails this Saturday. Presume independence between the emails and use a Binomial model to answer the following questions.

10a. Poor guy. How many responses does he expect? Show work.

$\mu = np = 20(0.06) = 1.2$ responses

10b. Determine the standard deviation for the number of responses. Show work.

$\sigma = \sqrt{np(1-p)} = \sqrt{20(0.06)(0.94)} \approx 1.062$

10c. Suppose this guy gets 5 responses. Explain why this is or isn't unusual. Show work.

5 is $\frac{5-1.2}{1.062} = 3.6$ Standard Deviations above the mean → Yes! Unusual!

OR $P(X \geq 5) = 0.0056$ is very unusual!

10d. *P*(At most 2 responses) = $P(X \leq 2) = 0.885$

10e. *P*(At least 2 responses) = $P(X \geq 2) = 0.3395$

10f. Why is it inappropriate to use the Normal approximation to this Binomial model?

need to expect 10 successes, 10 failures.

We expect only 1.2 successes.

Question 11: Regression, 4 points each.

11. Use the "**Direct Loans**" dataset to answer the following questions using "***Number of Loans***" to predict "***Loan Value***" in $ dollars. Included in the dataset are 63 colleges and universities. "***Number of Loans***" is the total number of students loans a college granted during one particular quarter. "***Loan Value***" is the total dollar value of the loans granted.

11a. Describe the relationship between the two variables, hitting all the important points and **including** a measure of strength in your write up.

Linear
Positive
Strong → r = 0.9839
~4 schools with large # loans / $ loans (but fit pattern)

11b. Determine the linear equation using StatCrunch. Explain why the *y*-intercept is meaningless in the context of this problem.

Equation: Loan Value = −474957 + 2366 (# of Loans)

y-intercept: (0 loans, −474957) is nonsense. How could a school issuing 0 loans have a loan value of −474957?

11c. Interpret the value of the slope with a sentence in context. For each extra loan granted, we expect a school's "Loan Value" to increase by $2366.

11d. Interpret the value of R^2 with a sentence in context. 96.81% of the variation in "Loan Value" is explained by knowing the number of Loans granted. 3.19% is unexplained.

11e. Interpret the value of s_e with a sentence in context. Our predicted "Loan Values" are off by about $1,207,259 on average when using "Number of Loans" as the explanatory variable.

11f. How many schools have unusual Studentized residuals and state how large a Studentized residual must be to be classified as "unusual":

How Many: 4

"Unusual" begins at: ± 2

11g. Calculate the Cook's Distance that is "large".

Large Cook's Distance: $4/63 \approx 0.0635$

How many schools exceed it: 5

11h. Interpret, in context, the residual (not the Studentized residual) for row 35, Medical College of Georgia.

This school granted $2,192,591 more in loans than expected for a school that granted x=1598 loans.

11i. If a school grants 2,545 loans, what is the expected "***Loan Value***"? $5,547,482

Show Calculation: Loan Value = −474958 + 2366(2545) = ↑

11j. Using a residual plot, which condition for linear regression is suspect and why?

Argue that "Equal Spread" condition is not met. Residual plot has some funneling.