Name: Key **Math 127 – Test 2 A – Fall 2014**

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

Sign Name: Key

There are 33 questions on this test, each worth 3 points. You get one point for printing your name.

1. Suppose McDonald's Quarter Pounder after cooking follows a N(3.14oz, 0.12oz) distribution. However, McDonald's website advertises that its weight after cooking is 3oz.
Round all probabilities to 4 decimal places (just give as decimals, don't convert to percentages). Round all weights to the hundredth.

1a. 0.1218 What percentage of quarter pounders are actually under the website ad weight?

1b. 0.0013 What is the probability that your next quarter pounder is over 3.5oz?

1c. 2.99 oz Determine the 10th percentile for the weight of quarter pounders.

1d. 0.5188 If you buy 5 quarter pounders this week, determine the probability that all 5 are between 3oz and 3.5oz. **Show calculation.**

$P(3 < x < 3.5) = 0.877$

$P(5 \text{ for } 5 \text{ in this range}) = (0.877)^5 = 0.5188$

1e. 0.4776 If you buy 5 quarter pounders, determine the probability that at least one of them is below the advertised weight. **Show calculation.**

$P(\text{Under } 3) = 0.1218 \quad P(\text{over } 3) = 0.8782$

$P(\text{at least one under}) = 1 - P(\text{all 5 over})$

$= 1 - (0.8782)^5 = 0.4776$

1f. 0.162 oz Determine the IQR for this distribution. Show calculation.

$Q_3 = 3.221$

$Q_1 = 3.059$

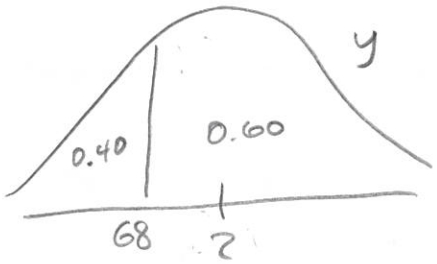
$IQR = 3.221 - 3.059 = 0.162$

1g. 2.9504 oz If a quarter pounder is known to have a z-score = –1.58, what was its weight? **Show calculation.**

$$z = \frac{y - \mu}{\sigma} \qquad -1.58 = \frac{y - 3.14}{0.12}$$

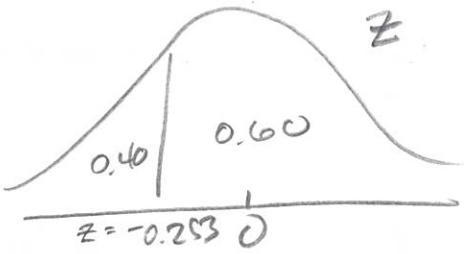
$$y = 3.14 - 1.58(0.12) = 2.9504$$

2. Heights of the male faculty at Cecil College follow a Normal model with an unknown mean and a standard deviation of 3 inches. We know that 40% of the male faculty are 68 inches or shorter. Determine the mean height and show work.



$\sigma = 3$

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



$$-0.253 = \frac{68 - \mu}{3}$$

$$\mu = 68 + 0.253(3)$$

$$\mu = 68.759''$$

3. Jack bought a new big screen TV and somewhere buried in the literature he read that its lifespan followed an exponential distribution with a mean of 20 thousand hours.

3a. Determine the first and third quartiles of this distribution. Then determine the IQR. **Show work**.

$Q_1 = 5.754$

$Q_3 = 27.726$

$IQR = Q_3 - Q_1$

$= 21.972$ thousand hours

3b. P(Jacks TV's lifespan exceeds 24 thousand hours) = 0.3012

3c. If Jack's friend Jill bought three of these TVs what is the likelihood that the lifespan of all three exceeds 24 thousand hours? 0.0273

$$(0.3012)^3 = 0.0273$$

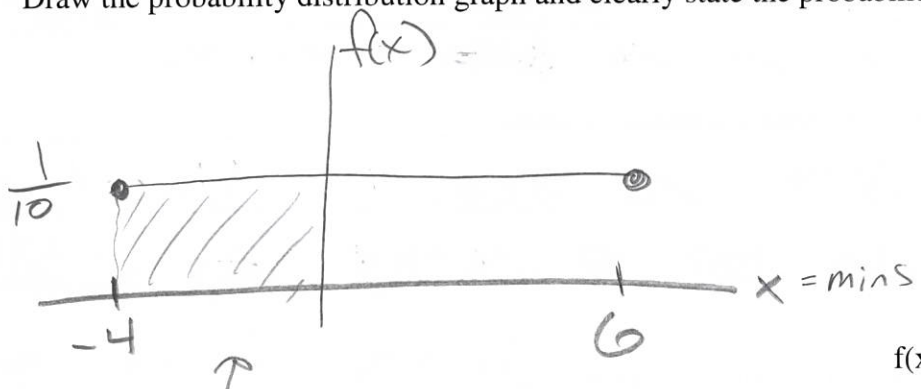
Not Graded.

4. Suppose that 90% of Cecil College students own a smart phone, 73% of Cecil College students own a tablet computer, and 67% of Cecil College students own both a smart phone and a tablet computer. Create the 2 by 2 contingency table using the above information. Label it clearly.

SMART PHONE → / TABLET ↓	YES	NO	TOTAL
YES	0.67	0.06	0.73
NO	0.23	0.04	0.27
TOTAL	0.90	0.10	1.00

5. Suppose that the time a professor ends class before or after the official end of class time follows a Uniform [-4, 6] distribution. Here X = -4 corresponds to the professor ends the class four minutes early, X = 6 corresponds to the professor ends class six minutes late and X = 0 corresponds to the professor ended class at the official end of call time.

5a. Draw the probability distribution graph and clearly state the probability function f(x):



f(x) = $\frac{1}{10}$, $-4 \le x \le 10$

5b. P(Class ends before the official end of class time) = 0.40

$P(-4 < x < 0) = 4 \times \frac{1}{10} = \frac{4}{10}$

5c. What is the mean of this distribution? 1 minute

$\mu = \frac{a+b}{2} = \frac{-4+6}{2} = \frac{2}{2} = 1$

6. Use the "**Body Fat**" dataset to answer the following questions using "***Waist (inches)***" to predict "***Body Fat %***".

6a. Describe the relationship between the two variables, hitting all the important points and **including** a measure of strength in your write up.

Vaguely linear, positive, pretty weak with $r = 0.46$ & No glaring outliers

6b. Determine the equation of the line of best-fit for this dataset. Explain why the *y*-intercept is meaningless in the context of this problem.

Equation: Body Fat% = 10.12% + 0.389(Waist)

y-intercept:

$x = 0$" Waist is way outside the scope of the data / reality.

6c. Interpret the value of the slope with a sentence in context.

For every extra one inch in Waist, we expect Body Fat to increase by 0.389%.

6d. Interpret the value of R^2 with a sentence in context. 21.17% of the variation in Body Fat can be explained by knowing Waist. The other 78.83% is explained by other variables.

6e. Interpret the value of s_e with a sentence in context. On average, our predicted Body Fat measurements are off by 4.0960%.

6f. How many observations have unusually large Studentized Residuals and state how large a residual must be to be classified as "unusual":

How Many: 0

"Unusual" begins at: ± 2

6g. State what value Cook's distance must exceed to be unusual and how many observations exceed this number.

How Many: 0 What value must it exceed? $\frac{4}{30} = 0.133$

6h. One person with a waist size of 35 inches was left out of this data. Predict his or her Percent of Body Fat. Now, ***if*** this person had 21.7% body fat what is the value of the residual?

Predicted value: $\widehat{\text{Body Fat}} = 23.72\%$

Residual: $e = 21.7\% - 23.72\% = -2.02\%$

6i. Find the value of the residual of the person in the 19th row and interpret it in context.

Residual: $e = -2.07\%$

Interpretation: This person's Body Fat is 2.06% less than what is expected, based on their Waist measurement.

6j. What graph besides the scatter plot do we need to look at to see if the equal spread assumption is met and circle if it is met?

Graph Residual Plot **Is it met?** (Circle) (Yes) No Can't Tell

6k. Describe just the distribution of the variable "***Body Fat %***" hitting on all four points mentioned in Unit 1.

Pretty unimodal & Symmetric

Mean = 22.87% No Obvious Outliers

St. Dev. = 4.53% No official Outliers

6l. Besides the histogram what other graph should we look at to see if "***Body Fat %***"is Normal and circle if it is Normal?

Graph QQ Plot **Is it normal?** (Circle) (Yes) (No) (Can't Tell)

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

Contingency table results:
Rows: Smart Phone
Columns: Text and Drive

	All the time	Never Ever	Occasionally	Total
No	0	27	6	33
Yes	19	108	146	273
Total	19	135	152	306

7a. P(Occasionally Text and Drive | Own a Smart Phone) = $\frac{146}{273} = 0.535$

7b. P(Do Not Own a Smart Phone | Never Ever Text and Drive) = $\frac{27}{135} = 0.2$

7c. P(Do Not Own a Smart Phone and Never Ever Text and Drive) = $\frac{27}{306} = 0.088$

8. The following table represents the number of students that arrive to campus, per 20 minutes, at the Math Lab.

Number of Students	0	1	2	3	4	5
Probability	0.01	0.15	0.20	0.30	0.25	0.09

8a. P(At most 3 students) = 0.66

8b. P(At least 3 students) = 0.64

8c. Determine the expected number of students. Show work.

$\mu = 0(0.01) + 1(0.15) + 2(0.20) + 3(0.30) + 4(0.25) + 5(0.09)$

$= 2.9$ students

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

Contingency table results:
Rows: Smart Phone
Columns: Text and Drive

	All the time	Never Ever	Occasionally	Total
No	0	27	6	33
Yes	19	108	146	273
Total	19	135	152	306

1a. P(Occasionally Text and Drive | Own a Smart Phone) = $\frac{146}{273} = 0.535$

1b. P(Do Not Own a Smart Phone | Never Ever Text and Drive) = $\frac{27}{135} = 0.2$

1c. P(Do Not Own a Smart Phone and Never Ever Text and Drive) = $\frac{27}{306} = 0.088$

2. The following table represents the number of students that arrive to campus, per 20 minutes, at the Math Lab.

Number of Students	0	1	2	3	4	5
Probability	0.01	025	0.30	0.20	0.15	0.09

2a. P(At most 3 students) = 0.76

2b. P(At least 3 students) = 0.44

2c. Determine the expected number of students. Show work.

$\mu = 0(0.01) + 1(0.25) + 2(0.30) + 3(0.20) + 4(0.15) + 5(0.09)$

$= 2.5$ students

3. Use the "**Body Fat**" dataset to answer the following questions using "***Waist (inches)***" to predict "***Body Fat %***".

3a. Describe the relationship between the two variables, hitting all the important points and **including** a measure of strength in your write up.

Vaguely linear, positive
Pretty weak with $r = 0.46$
No Glaring Outliers

3b. Determine the equation of the line of best-fit for this dataset. Explain why the y-intercept is meaningless in the context of this problem.

Equation: $\widehat{\text{Body Fat \%}} = 10.12\% + 0.389(\text{Waist})$

y-intercept: $x = 0$" Waist is outside scope of data and reality.

3c. Interpret the value of the slope with a sentence in context. For every extra one inch in Waist, we expect Body Fat to increase by 0.389%

3d. Interpret the value of R^2 with a sentence in context. 21.17% of the variation in Body Fat can be explained by knowing Waist. The other 78.83% is explained by other variables.

3e. Interpret the value of s_e with a sentence in context. On average, our predicted Body Fat Measurements are off by 4.096%.

3f. How many observations have unusually large Studentized Residuals and state how large a residual must be to be classified as "unusual":

How Many: 0

"Unusual" begins at: ± 2

3g. State what value Cook's distance must exceed to be unusual and how many observations exceed this number.

How Many: 0 What value must it exceed? $\frac{4}{30} = 0.133$

3h. One person with a waist size of 37 inches was left out of this data. Predict his or her Percent of Body Fat. Now, ***if*** this person had 21.7% body fat what is the value of the residual?

Predicted value: Body Fat % = 24.50%

Residual: e = 21.7% - 24.5% = -2.8%

3i. Find the value of the residual of the person in the 16th row and interpret it in context.

Residual: e = -7.88%

Interpretation: This person's Body Fat is 7.88% less than expected, Based on their Waist measurement.

3j. What graph besides the scatter plot do we need to look at to see if the equal spread assumption is met and circle if it is met?

Graph Residual Plot **Is it met?** (Circle) (Yes) No Can't Tell

3k. Describe just the distribution of the variable "***Body Fat %***" hitting on all four points mentioned in Unit 1.

Pretty Unimodal & Symmetric

Mean = 22.87% No obvious, no official outliers

St. Dev. = 4.53%

3l. Besides the histogram what other graph should we look at to see if "***Body Fat %***"is Normal and circle if it is Normal?

Graph QQ Plot **Is it normal?** (Circle) (Yes) No (Can't Tell)

4. Suppose McDonald's Quarter Pounder after cooking follows a N(3.14oz, 0.12oz) distribution. However, McDonald's website advertises that its weight after cooking is 3oz.
Round all probabilities to 4 decimal places (just give as decimals, don't convert to percentages). Round all weights to the hundredth.

4a. 0.1218 What percentage of quarter pounders are actually under the website ad weight?

4b. 0.0151 What is the probability that your next quarter pounder is over 3.4oz?

4c. 3.039oz Determine the 20th percentile for the weight of quarter pounders.

4d. 0.5916 If you buy 4 quarter pounders this week, determine the probability that all 4 are between 3oz and 3.5oz. **Show calculation.**

$P(3 < x < 3.5) = 0.877$

$P(4 \text{ for } 4 \text{ in this range}) = (0.877)^4$

$=$

4e. 0.3227 If you buy 3 quarter pounders, determine the probability that at least one of them is below the advertised weight. **Show calculation.**

$P(\text{at least one in 3 is under 3oz}) =$

$1 - P(\text{all 3 are over}) =$

$1 - (0.8782)^3 = 0.3227$

4f. 0.162 Determine the IQR for this distribution. Show calculation.

$Q_3 = 3.221$ $\quad IQR = 3.221 -$

$Q_1 = 3.059$ $\quad 3.059$

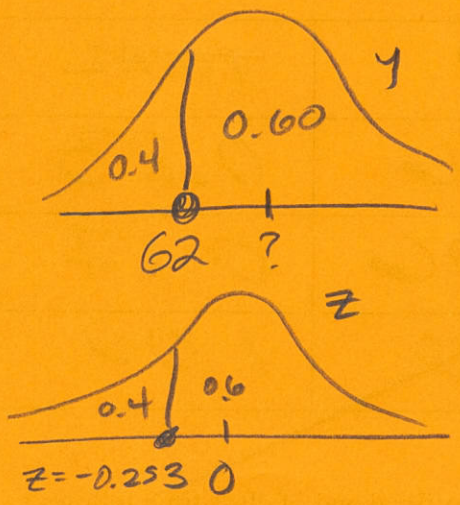
$= 0.162$

4g. 2.8304oz If a quarter pounder is known to have a z-score = –2.58, what was its weight? **Show calculation.**

$z = \frac{y - \mu}{\sigma} \qquad -2.58 = \frac{y - 3.14}{0.12}$

$y = 3.14 - 2.58(0.12) = 2.8304\text{oz}$

5. Heights of the female faculty at Cecil College follow a Normal model with an unknown mean and a standard deviation of 3 inches. We know that 40% of the female faculty are 62 inches or shorter. Determine the mean height and show work.



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

$$-0.253 = \frac{62-\mu}{3}$$

$$\mu = 62 + 0.253(3)$$

$$\mu = 62.759"$$

6. Jack bought a new big screen TV and somewhere buried in the literature he read that its lifespan followed an exponential distribution with a mean of 18 thousand hours.

6a. Determine the first and third quartiles of this distribution. Then determine the IQR. **Show work.**

$Q_1 = 5.178$

$Q_3 = 24.953$

$IQR = 24.953 - 5.178$
$= 19.775$ hours.

6b. P(Jacks TV's lifespan exceeds 20 thousand hours) = 0.3292

6c. If Jack's friend Jill bought three of these TVs what is the likelihood that the lifespan of all three exceeds 20 thousand hours? 0.0357

$(0.3292)^3 = 0.0357$

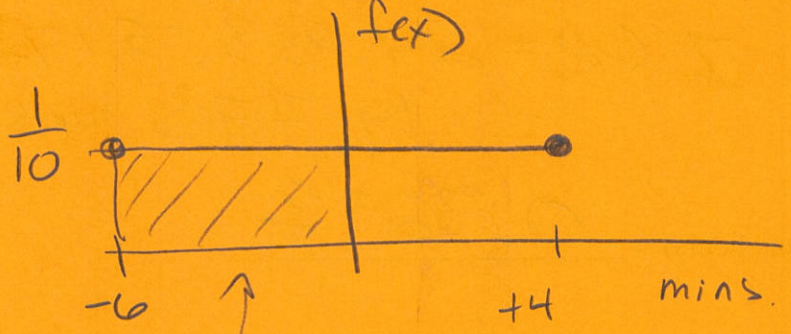
Impossible Problem ...

7. Suppose that 90% of Cecil College students own a smart phone, 83% of Cecil College students own a tablet computer, and 67% of Cecil College students own both a smart phone and a tablet computer. Create the 2 by 2 contingency table using the above information. Label it clearly.

SMART PHONE → / TABLET ↓	YES	NO	TOTAL
YES	0.67	0.16	0.83
NO	0.23	0.06	0.17
TOTAL	0.90	0.10	1.00

8. Suppose that the time a professor ends class before or after the official end of class time follows a Uniform [-6, 4] distribution. Here X = -6 corresponds to the professor ends the class six minutes early, X = 4 corresponds to the professor ends class four minutes late and X = 0 corresponds to the professor ended class at the official end of call time.

8a. Draw the probability distribution graph and clearly state the probability function f(x):



f(x) = $\frac{1}{10}$, $-6 \le x \le 4$

8b. P(Class ends before the official end of class time) = 0.60

$P(-6 < x < 0) = 6 \times \frac{1}{10} = 0.60$

8c. What is the mean of this distribution? -1 minute.

$\mu = \frac{a+b}{2} = \frac{-6+4}{2} = \frac{-2}{2} = -1$ min.