NAME: Key **Math 214 - Exam 1**

Justify answers and show all work for full credit.

Problem 1:
The following comes from an online news source:

> MONDAY, March 5 (HealthDay News) – Childhood obesity may lead to earlier onset of puberty for girls, a U.S. study concludes.
>
> The study of 354 girls from 10 different regions in the United States found that increased body fat in girls as young as age 3 and large increases in body fat between the age of 3 and the start of first grade were associated with earlier puberty, defined as the presence of breast development by age 9.
>
> "Our finding that increased body fatness is associated with the earlier onset of puberty provides additional evidence that growing rates of obesity among children in this country may be contributing to the trend of early maturation in girls," study lead author Dr. Joyce Lee, a pediatric endocrinologist at the University of Michigan, said in a prepared statement.
>
> Her team published the findings in the March issue of Pediatrics.
>
> Lee noted that girls in the United States are entering puberty at younger ages than they were 30 years ago. Over that same time, there's been a significant increase in obesity rates among American children.

Based on the reading answer the following:

2 1. What is an *experimental unit* in the study? Girls

2 2. What is the sample size? 354

4 3. What were the statistics collected? Body fat, "presence of breast development ("early puberty") by age 9" or "onset of puberty"

4 4. Catagorize the statistics as numerical or catagorical.

Body fat – numerical

breast development - categorical

100

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Problem 2:
The following are a sample of the monthly rental prices for apartments in Biloxi Mississippi.

```
[1] "rent"

 [1] 290 180 320 260 160 980 470 150 120 850
```

1. Arrange the data in a stem and leaf diagram. The stem should be the hundreds place.
2. Based on the stem and leaf diagram, find the values of the minimum, median, and maximum.
3. Based on the stem and leaf diagram, would you expect the mean to be larger or lower than the median? Explain why?

6 1)

1	20 50 60 80
2	60 90
3	20
4	70
5	
6	
7	
8	50
9	80

4 2) min = 120 1
median = 275 2
max = 980 1

2 3) mean > median (skewed right)

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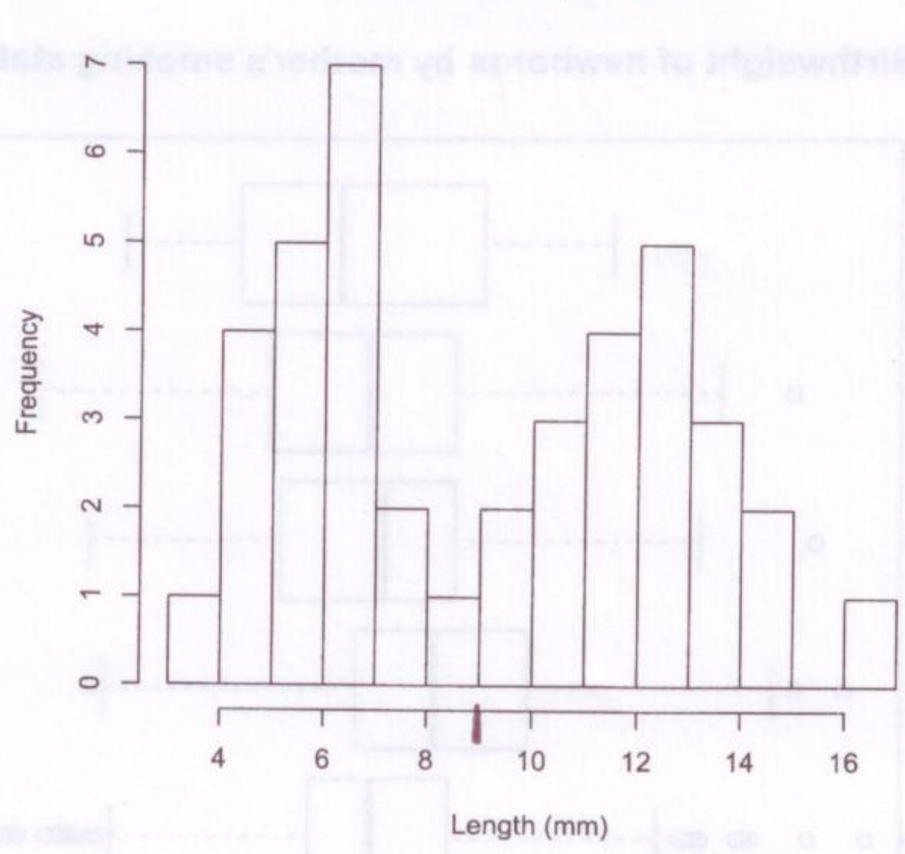
Problem 3:
A data set on the size, in millimeters, of a sample of 40 potato bugs produces the following histogram:



1. What percentage of bugs have length less than 10 mm? (None have exactly 10)
2. Find the median, Q_1 and Q_3. Compute the IQR.
3. Construct the corresponding boxplot.

2 1) $\frac{22}{40} = 55\%$

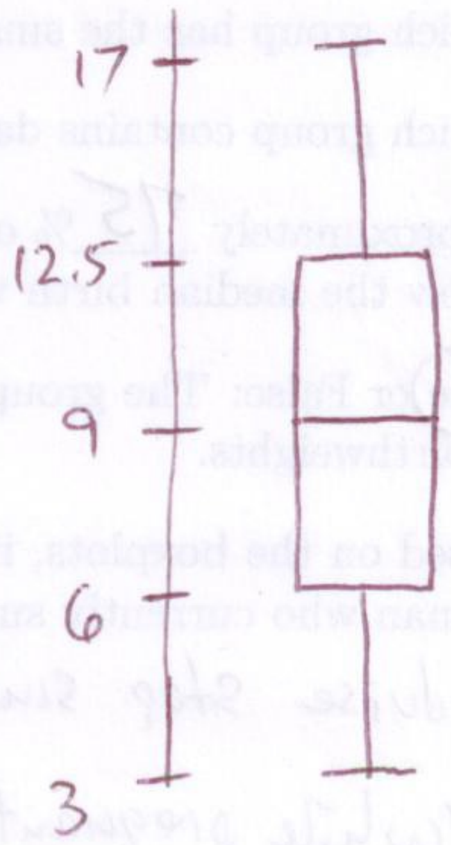
4 2) median = 9

$Q_1 = 6$

$Q_3 = 12.5$ (approx.)

IQR = 6.5 (approx.)

6 3)



1 label/scale
1 pt for each correct number
1 pt for

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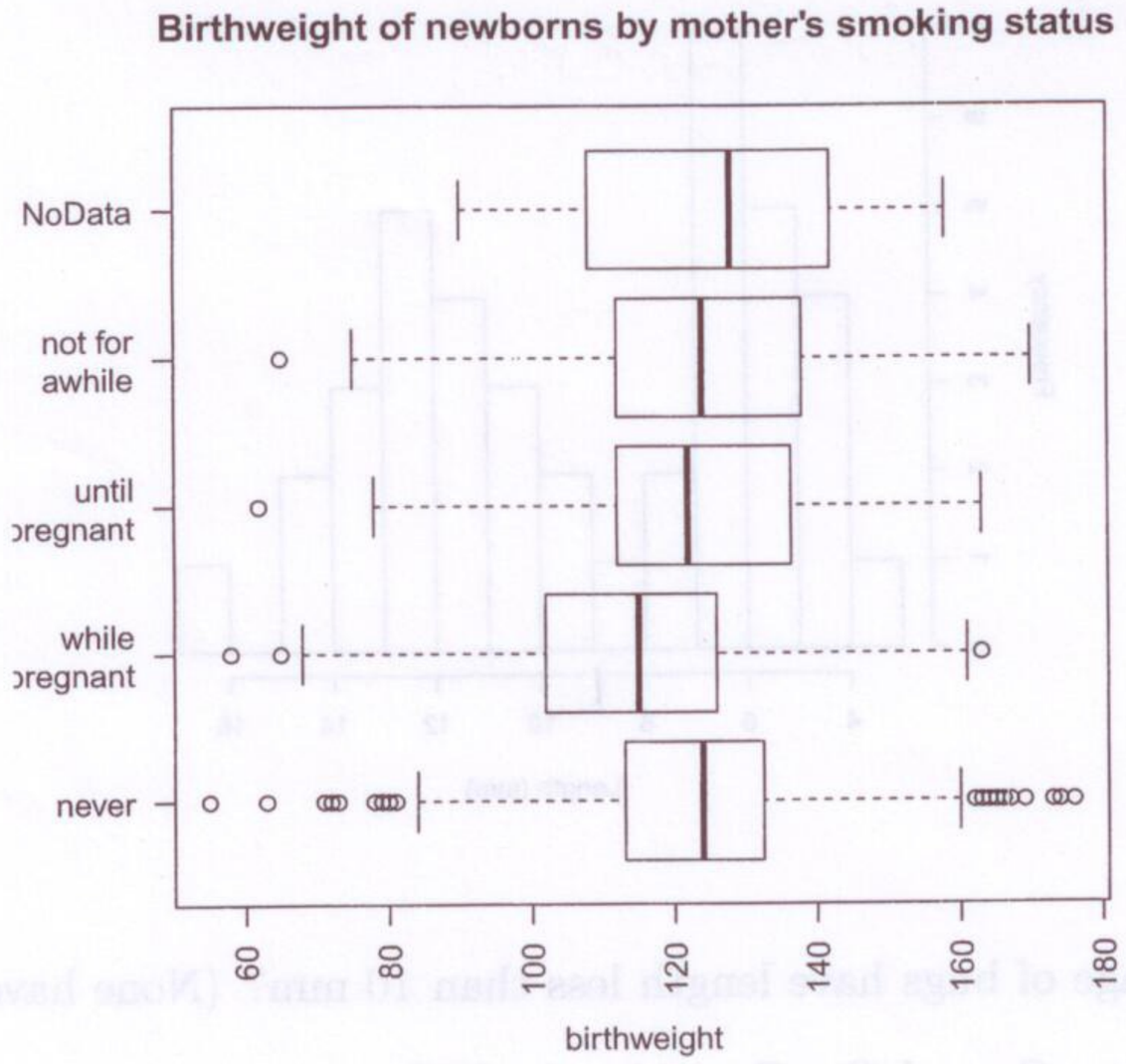
Problem 4:
The following data comes from a study of birthweights of newborn babies. The data set of over 1,000 newborns was broken up by the smoking status of the mother. For each group a boxplot was produced.



Based on the boxplots, answer the following questions:

2 1. Which group has the smallest median birthweight? Smoking while pregnant

2 2. Which group contains data for the baby with the smallest birthweight? never smoked

2 3. Approximately 75 % of babies born to mothers who smoked during pregnancy were below the median birth weight of babies born to mothers who never smoked.

2 4. True or False: The group with the largest range of birthweights has the smallest IQR of birthweights.

4 5. Based on the boxplots, if you were a doctor what would you advise a newly pregnant woman who currently smokes? Why? Use the boxplots to justify your explanation.

Advise stop smoking – compare "until pregnant" with "while pregnant," almost 75% of "until pregnant" are above median of "while pregnant."

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Problem 5:
A game consists of rolling two fair dice, a 4-sided tetrahedron and a 6-sided cube, then adding up their scores. The random variable X is the sum of the numbers on the two dice.

1. List the sample space of the game; i.e., enumerate all possible outcomes, X.
2. What is the probability of rolling a 3? (i.e., what is the probability that $X = 3$?)
3. Determine the probabilities $P(X < 5)$ and $P(X \neq 8)$.
4. Draw the probability distribution of X.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10

OR →

2 1) $S = \{2, 3, 4, 5, 6, 7, 8, 9, 10\}$

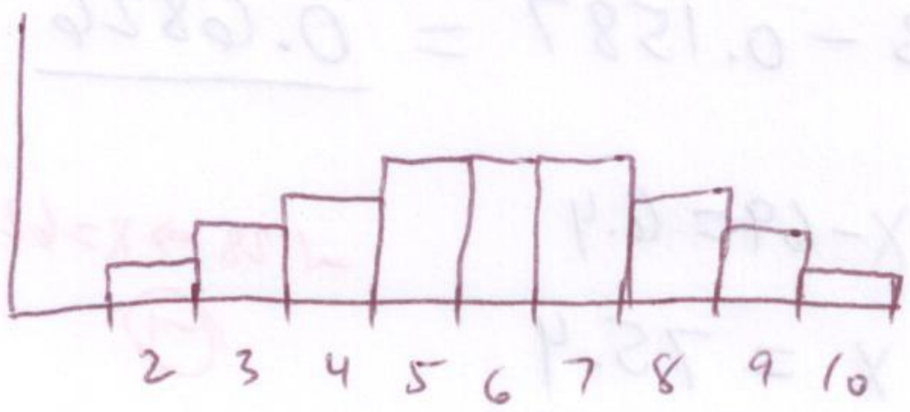
2 2) $P(X=3) = \frac{2}{24} = 0.08\overline{3} = \frac{1}{12}$

2 3) $P(X<5) = \frac{6}{24} = 0.25 = \frac{1}{4}$

2 $P(X \neq 8) = \frac{21}{24} = 0.875 = \frac{7}{8}$

4 4)

2	3	4	5	6	7	8	9	10
$\frac{1}{24}$	$\frac{2}{24}$	$\frac{3}{24}$	$\frac{4}{24}$	$\frac{4}{24}$	$\frac{4}{24}$	$\frac{3}{24}$	$\frac{2}{24}$	$\frac{1}{24}$



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Problem 6:
Let $\mathbf{Z}$ be a normally distributed random variable with mean $\mu = 0$ and standard deviation $\sigma = 1$.

3 1. Find $P(\mathbf{Z} < -0.5)$ $= 0.3085$

3 2. Find $P(0 < \mathbf{Z} < 1.5)$ $= 0.9332 - 0.5 = 0.4332$

-2

Problem 7:
The average time for an Empire penquin egg to hatch is 69 days with a standard deviation of 5 days. Assume the distribution of times is normally distributed.

Based on these assumptions answer the following using Table A:

1. Find the probability that a randomly chosen egg hatches in 72 or more days.

2. Find the probability that a randomly chosen egg hatches between 64 and 74 days.

3. 10% of the eggs take longer than x days to hatch. What is x?

4 1) $\mu = 69, \ \sigma = 5, \ X \geq 72 \quad z \geq \frac{X-\mu}{\sigma} = \frac{72-69}{5} = 0.6$ /2pts.

$P(z \geq 0.6) = 0.2743$ 0.7257 -2

4 2) $64 \leq X \leq 74 \quad \frac{64-69}{5} \leq z \leq \frac{74-69}{5} \quad -1 \leq z \leq 1$ /2pts.

$P(-1 \leq z \leq 1) = 0.8413 - 0.1587 = 0.6826$ (accept 68%)

4 3) $z = \frac{X-69}{5} = 1.28 \Rightarrow X - 69 = 6.4$ $-1.28 \Rightarrow X = 62.6$

/1pt. /2pts. $X = 75.4$ -1

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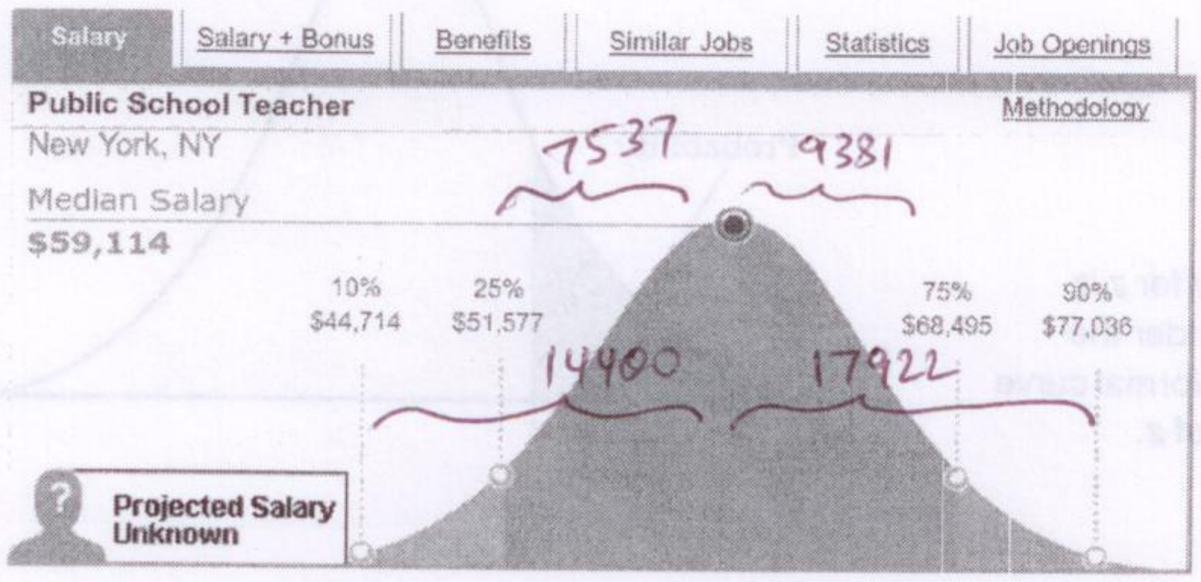
Problem 8:
Below is a screenshot from salary.com showing the distribution of public school teacher salaries in New York City.



2

1. What percentage of teachers earn between $ 51,577 and $ 77,036? 65%

4

2. The distribution is actually skewed a little. Right or left? Which is bigger, mean or median?

4

3. Assuming the distribution is approximately normal, what is the standard deviation? (Hint: Use Table A)

$z = \frac{x-\mu}{\sigma}$ $\quad 0.67 = \frac{9381}{\sigma}$ (75%) or $1.28 = \frac{17922}{\sigma}$ (90%)

using Right side $\sigma = \$14{,}000$ (approx.) || Left side $\Rightarrow$ $\sigma = \$11{,}250$ (approx)

Problem 9:
Consider the distribution of a random variable X having possible values 1, 2, 3, 4 with probabilities given by

k	1	2	3	4
P(X=k)	1/10	2/10	???	4/10

1. Find the value of P(X = 3). $1 - \frac{7}{10} = \frac{3}{10}$
2. Find μ_X, the expected value of X . Show your work.
3. Find σ_X, the standard deviation of X. Show your work.

4 1) $P(X=3) = 0.3$

4 2) $\mu_X = (1 \cdot \frac{1}{10} + 2 \cdot \frac{2}{10} + 3 \cdot \frac{3}{10} + 4 \cdot \frac{4}{10}) = \frac{30}{10} = 3$

4 3) $\sigma_X = \sqrt{(1-3)^2 \frac{1}{10} + (2-3)^2 \frac{2}{10} + (4-3)^2 \frac{4}{10}} = \sqrt{1} = 1$

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