Probability WS 1 Counting

1.28

2.13,800

3.5832

4.360

5. 66

6. 15

7.72

8.336, 56

11. 15,504

12. a)625 b)1050c)2275

13. a)20358,520 b) 1716 c) 55,770 d) 12,271,512e) 1128 f) 176

14. 4368

15. 26,000

16. 161,700

17. 220, 31

18. a) 60 b) 3600

19. 4060

20. a) 40320 b) 5040

21. 12*20*3=2160

22. 7520

2. In a drawer are 6 white socks and 2 black socks. In the dark you reach in and pull out two socks hoping to get a matching pair. Determine the probability:

a. Neither is white $\frac{2}{8}\cdot\frac{1}{7}=\frac{1}{28}$

b. You get one of each color (NB or BW) $\frac{6}{8}\cdot\frac{2}{7}+\frac{2}{8}\cdot\frac{6}{7}=\frac{12}{28}=\frac{3}{7}$

c. Both are white $\frac{6}{8}\cdot\frac{5}{7}=\frac{15}{28}$

d. Both are black (same as a) $\frac{2}{8}\cdot\frac{1}{7}=\frac{1}{28}$

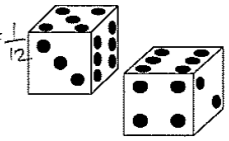
3. Two dice are rolled. Determine the probability:

a. Sum is 10 $\frac{3}{36}=\frac{1}{12}$

b. Sum is greater than 10 $\frac{3}{36}=\frac{1}{12}$

c. You get doubles $\frac{6}{36}=\frac{1}{6}$

d. You do not get doubles $\frac{30}{36}=\frac{5}{6}$



	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
5	6	7	8	9	10	11
6	7	8	9	10	11	12

4. Three dice are rolled. Without writing out the entire sample space, determine the probability:

a. Sum is 5 (3 → 36) $\frac{6}{63}=\frac{1}{36}$

1,1,3 1,2,2
1,3,1 2,1,2
3,1,1 2,2,1

b. Sum is greater than 15 10/216

5. From a normal deck of 52 cards, a five card hand is drawn. Determine the probability for each (show set up and answer)

a. One of the cards is an ace $_4C$

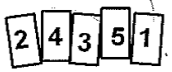
b. You get four aces

c. You get two aces and three kings

d. None of the cards is an ace

e. You get at least one ace

a) $\frac{{}_4C_1\cdot{}_{48}C_4}{{}_{52}C_5}$ b) $\frac{{}_4C_4\cdot{}_{48}C_1}{{}_{52}C_5}$ c) $\frac{{}_4C_2\cdot{}_4C_3}{{}_{52}C_5}$ d) $\frac{{}_{48}C_5}{{}_{52}C_5}$ e) $1-(d)$

6. Two numbers are picked from the set 

What is the probability the:

a. Their sum is greater than 5 $\frac{3}{5}$

b. Their sum is less than 4 $\frac{2}{10}=\frac{1}{5}$

c. Their product is greater than 10 $\frac{3}{10}$

d. Their product is greater than 20 0

1,2 2,3 3,4 4,5
1,3 2,4 3,5
1,4 2,5
1,5

= 10 outcomes

7. There are three men and seven women applying for the same two jobs. What is the probability that at random:
   a. Men are hired for the two jobs
   b. One man and one woman are hired
   c. Two women are hired
   d. At least one woman is hired

a) $\frac{{}_3C_2}{{}_{10}C_2}$ b) $\frac{{}_3C_1 \cdot {}_7C_1}{{}_{10}C_2}$ c) $\frac{{}_7C_2}{{}_{10}C_2}$ d) add b + c

8. A young couple decides to have four children. Determine the probability:

Probability WS 3- Answers Coming :)

Probability Review WS Answers

WS- Probability Review ANSWERS

1. 220 own both
2. ${}_{10}P_4 = 5040$
3. $\frac{14!}{3!4!5!1!1!} = 5{,}045{,}040$
4. $(8-1)! = 5040$
5. $({}_9C_1)({}_8C_4)+({}_9C_0)({}_8C_5) = 686$
6. $\frac{6}{9} = 0.\overline{6}$
7. $\frac{({}_{12}C_5)({}_{40}C_3)}{({}_{52}C_8)} = 0.0104$
8. $\frac{9}{20} = 0.45$
9. $\frac{4}{36-4} = \frac{4}{32} = \frac{1}{8} = 0.125$

10. $\frac{3}{11}\cdot\frac{8}{10}+\frac{8}{11}\cdot\frac{3}{10}=\frac{48}{110}=0.4364$

11. $\frac{7}{15}\cdot\frac{8}{14}+\frac{8}{15}\cdot\frac{7}{14}+\frac{7}{15}\cdot\frac{6}{14}=\frac{154}{210}=0.7\overline{3}$

12a. $\frac{80}{155}=0.5161$

12b. $\frac{20}{25}=0.80$

12c. $\frac{20}{155}\neq\frac{80}{155}\cdot\frac{25}{155}$ So not independent

13. $\frac{(0.60)(0.75)}{(0.60)(0.75)+(0.40)(0.85)}=0.5696$

14. $\frac{8!}{6!2!}(.20)^6(.80)^2+\frac{8!}{7!1!}(.20)^7(.80)^1+\frac{8!}{8!0!}(.20)^8(.80)^0=0.0012$

15. $\frac{4!}{3!1!}(.50)^3(.50)^1+\frac{4!}{2!2!}(.50)^2(.50)^2=0.625$

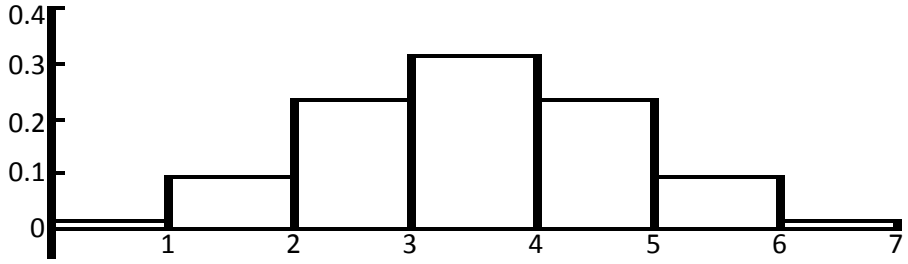
Chapter 13 **ANSWERS**
WS- Statistics Day 1: Probability Distributions

1 a. $\{0, 1, 2, 3, 4, 5, 6\}$

b.

$0: \frac{6!}{0!6!}(0.5)^0(0.5)^6 = 0.015625$	$1: \frac{6!}{1!5!}(0.5)^1(0.5)^5 = 0.09375$
$2: \frac{6!}{2!4!}(0.5)^2(0.5)^4 = 0.234375$	$3: \frac{6!}{3!3!}(0.5)^3(0.5)^3 = 0.3125$
$4: \frac{6!}{4!2!}(0.5)^4(0.5)^2 = 0.234375$	$5: \frac{6!}{5!1!}(0.5)^5(0.5)^1 = 0.09375$
$6: \frac{6!}{6!0!}(0.5)^6(0.5)^0 = 0.015625$	

c.



d. $P(\geq 4) = 0.234375 + 0.09375 + 0.015625$
$P(\geq 4) = 0.34375$

e. A student should expect to get 3 correct.

2 a. $\{1, 2, 3, 4, 5, 6\}$

b. Probability of each is $\frac{1}{6}$

c. NO. Imagine a histogram with each bin going up to 0.16666.

d. $1\left(\frac{1}{6}\right) + 2\left(\frac{1}{6}\right) + 3\left(\frac{1}{6}\right) + 4\left(\frac{1}{6}\right) + 5\left(\frac{1}{6}\right) + 6\left(\frac{1}{6}\right) = 3.5$ You'll never roll it.

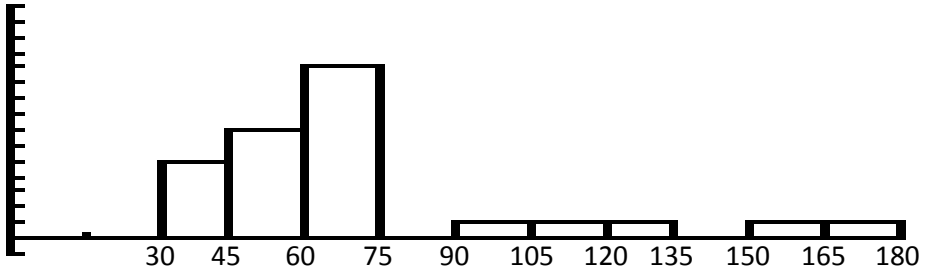
e. This represents theoretical probability.

3 a. Results will vary, but be close to a frequency of 8 or 9.
b. Results will vary.

4 a.

$30 \le x < 45$	5
$45 \le x < 60$	7
$60 \le x < 75$	11
$75 \le x < 90$	0
$90 \le x < 105$	1
$105 \le x < 120$	1
$120 \le x < 135$	1
$135 \le x < 150$	0
$150 \le x < 165$	1
$165 \le x < 180$	1

b.



c. $\frac{5}{28} = 0.1786$

5 a. $\{0, 500\}$

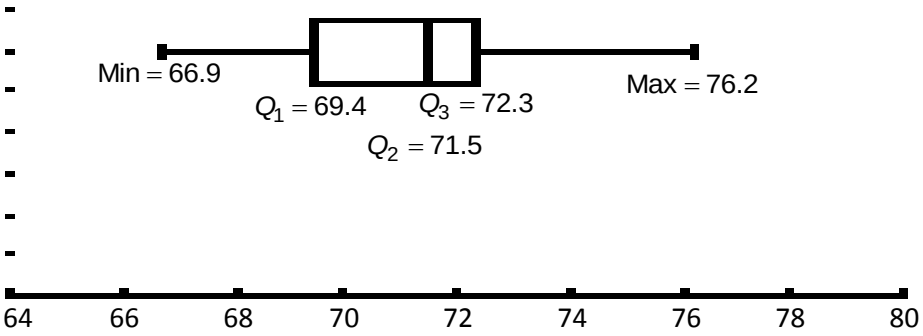
b. $0 : \frac{999}{1000}$ $500 : \frac{1}{1000}$

c. The histogram will have the bar for 0 up to 0.999 and the bar for 500 up to 0.001.

d. $\left(\frac{999}{1000}\right)0 + \left(\frac{1}{1000}\right)500 = 0.50$ So the expected winnings are \$0.50

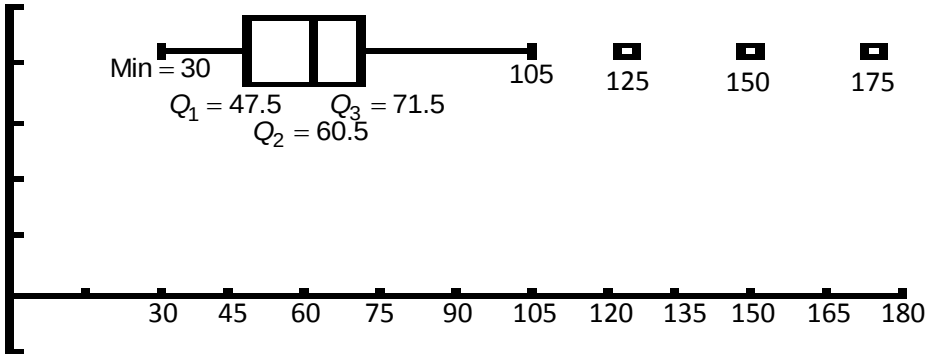
e. A fair price would be \$0.50 per ticket.

Analysis CP- Chapter 13 **ANSWERS**
WS- Statistics Day 2: Describing Distributions



1. 1: Symmetric
   2: Uniform
   3: Uniform
   4: Skewed right
   5: Bimodal

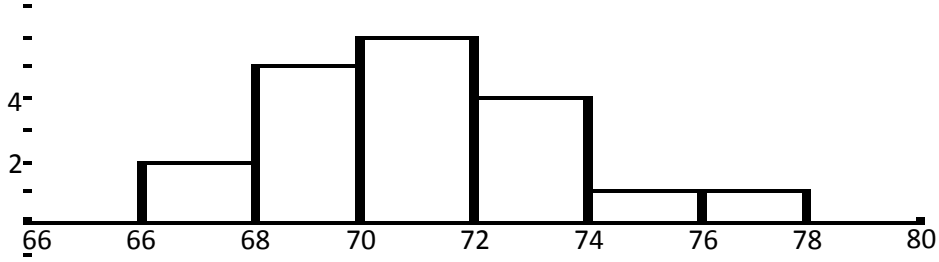
2 a. Mean: 68.3929 Median: 60.5
Median is better because it better disregards the extreme outliers.
b. Range: 145 IQR: 24
IQR is better because it uses the median, which disregards outliers.
c. Standard Deviation: 34.0504
d. $47.5 - 1.5(24) = 11.5$ and $71.5 + 1.5(24) = 107.5$. So 125, 150, and 175 are outliers.
e.



3 $\sqrt{\dfrac{(0-5)^2+(2-5)^2+(5-5)^2+(8-5)^2+(10-5)^2}{5-1}}$

$\sqrt{\dfrac{25+9+0+9+25}{4}} = \sqrt{\dfrac{68}{4}} = \sqrt{17} = 4.1231$

4 a.



b. The shape is normal with a very slight positive skewing.
c. Mean: 71.1 Median: 71.5 Mode: $70 \le x < 72$
The three measures of central tendency are all at about the same spot.

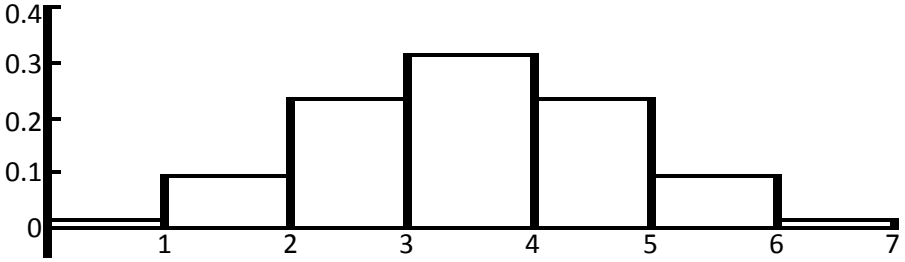
4 d.

There are no outliers

e. The middle 50% of the heights are found between 69.4 and 72.3

f. The shortest 25% are from 66.7-69.4. The tallest 25% are from 72.3-76.2

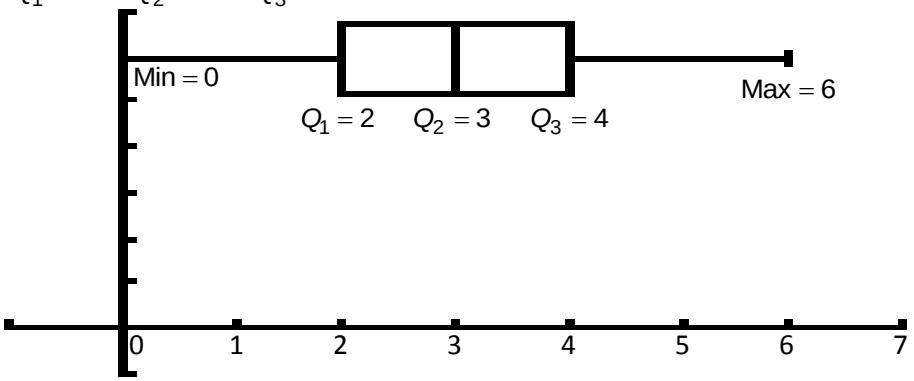
5 a. Done.

b. 

c. The median is 3, the same as the expected value.

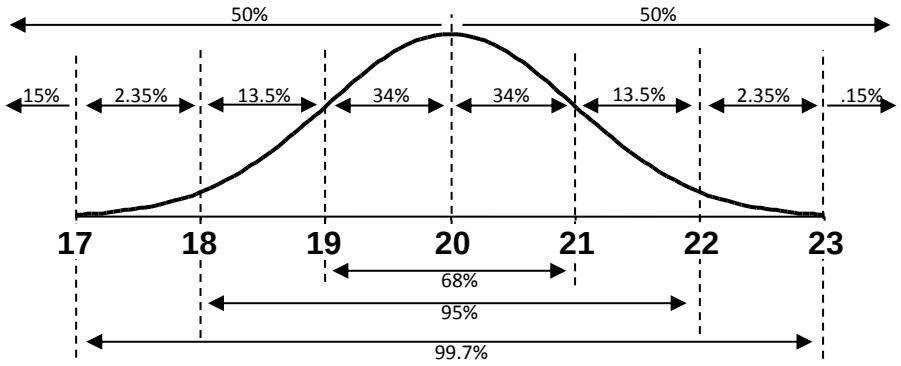
d. There is no sample standard deviation, but $\sigma = 1.2247$

e. $Q_1 = 2$ $Q_2 = 3$ $Q_3 = 4$

f. 

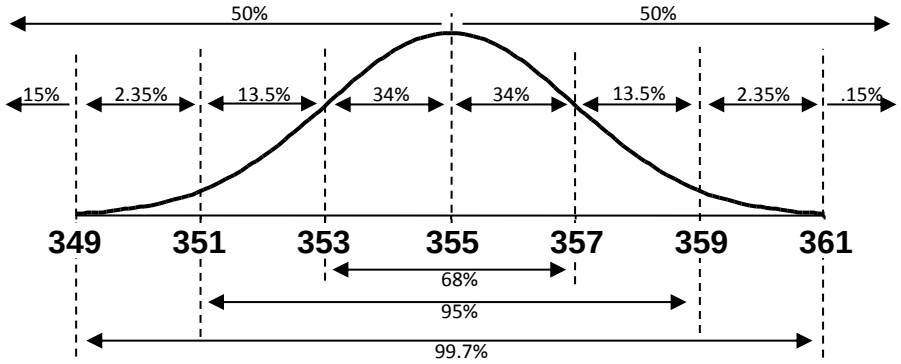
Analysis CP- Chapter 13 **ANSWERS**
WS- Statistics Day 3: Normal Distributions

1 a.



b. 50% are longer than 20 inches
c. $97.7 - 15.9 = 81.8\%$
d. Only .13% (or 13/1000) babies are 23 inches or longer. So it is unusual.
e. 95% of babies would be born between 18 and 22 inches.

2 a.



b. $(.025)2000 = 50$ or $(1-.977)2000 = 46$
c. $(.68)2000 = 1360$ or $(.841-.159)2000 = 1364$
d. $(.067)2000 = 134$
e. $(1-.994)2000 = 12$

3 a. About 30.9% score below 98.
b. About 16% (Emperical) or about 15.9% (Standardized)
c. Top 2% is about 2σ above the mean. So about 160 points.

4 a. About 16% (Emperical) or about 15.9% (Standardized)
b. About 34% (Emperical) or about 34.1% (Standardized)
c. About 43.3% (Standardized) $(.500 - .067) = 0.433$
d. About 64 points (Standardized) -2σ is a percentile rank of 2.3%

5 a. 4th Grader: $\frac{71-75}{12} = -0.\overline{3}$ 6th Grader: $\frac{79-85}{8} = -0.75$

b. As compared to his classmates, his reading is in decline because the standard deviation is increasing each year and therefore he is getting further away from the mean.

c. Yes. Otherwise the z-scores are not valid.

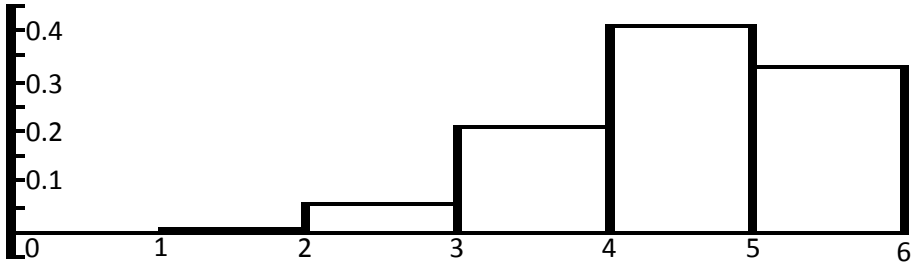
Analysis CP- Chapter 13 **ANSWERS**
WS- Statistics Day 4: Review

1 a. $X = \{0, 1, 2, 3, 4, 5\}$

b.

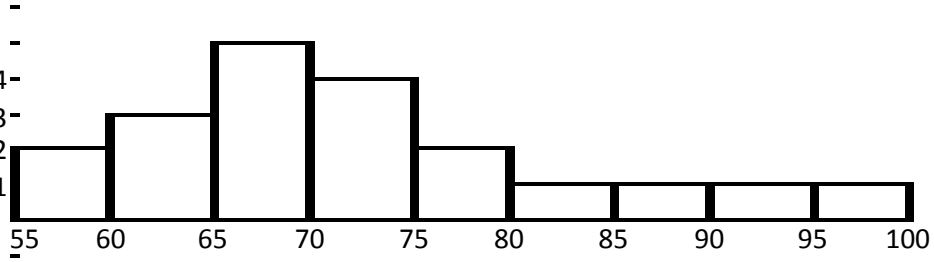
$0: \frac{5!}{0!5!}(0.8)^0(0.2)^5 = 0.00032$	$1: \frac{5!}{1!4!}(0.8)^1(0.2)^4 = 0.0064$
$2: \frac{5!}{2!3!}(0.8)^2(0.2)^3 = 0.0512$	$3: \frac{5!}{3!2!}(0.8)^3(0.2)^2 = 0.2048$
$4: \frac{5!}{4!1!}(0.8)^4(0.2)^1 = 0.4096$	$5: \frac{5!}{5!0!}(0.8)^5(0.2)^0 = 0.32768$

c.

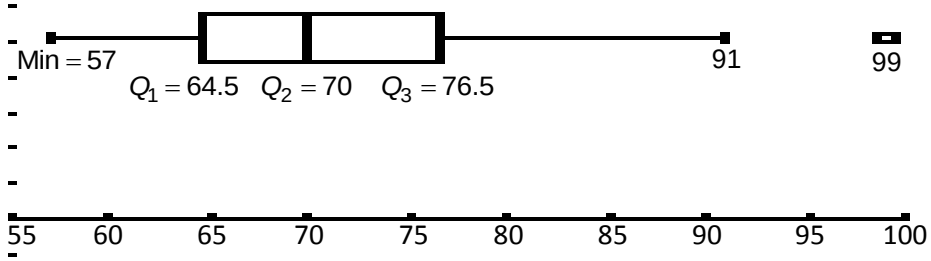


a. The data is negatively skewed
b. The expected value is 4. This means that if the person takes 5 free-throws, they should make 4 of them.

2 a.



b. The data is positively skewed.
c. IQR: 12 $64.5 - 1.5(12) = 46.5$ and $76.5 + 1.5(12) = 94.5$ so 99 is an outlier.
d.



e. The interval $64.5 \le x \le 76.5$ contains 50% of the students.

3 a. Let A be the number of animals a family has.

$A = \{0, 1, 2, 3, 4, 5, 6, 7\}$

b. $\frac{8+6+2}{100} = 0.16$

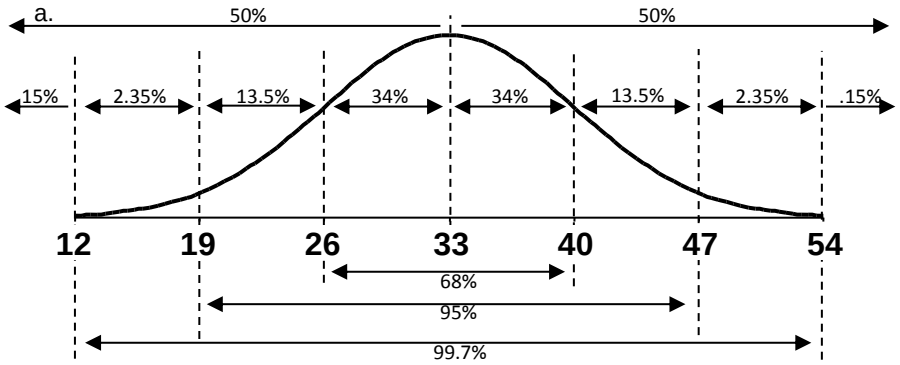
c. $0(.14)+1(.22)+2(.20)+3(.18)+4(.10)+5(.08)+6(.06)+7(.02) = 2.46$

4 $\sqrt{\frac{(7-10)^2+(8-10)^2+(9-10)^2+(10-10)^2+(11-10)^2+(12-10)^2+(13-10)^2}{7-1}}$

$\sqrt{\frac{9+4+1+0+1+4+9}{6}} = \sqrt{\frac{28}{6}} = \sqrt{\frac{14}{3}} = 2.1602$

This value shows how spread out the data is from the mean.

5 a.



b. About 16% (Emperical) or about 15.1% (Normalized)

c. The middle 95% commutes between 19 and 47 minutes (Emperical)

d. 81.5% of the employees commute between 26 and 47 minutes.

e. 50 minutes is about 2.4286 standard deviations above the mean. That equates to roughly 99.4% (99.2421% using normalcdf). So only 0.60%-0.75% would commute more than 50 minutes. Depending on the size of the company, it may or may not be surprising.

6 Midterm: $\frac{72-84}{8} = -1.5$ Final: $\frac{66-77}{11} = -1.0$

Compared to the other students, her test scores are improving since her standard deviation is decreasing and therefore getting closer to the mean.