

$$\text{midrange} = \frac{\text{lowest value} + \text{highest value}}{2} \quad \text{range} = \text{highest value} - \text{lowest value}$$

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n} = \frac{\sum_i x_i}{n} = \frac{\sum_i x_i f_i}{n} \quad Z = \frac{X - \bar{x}}{s}$$

$$s = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{n - 1}} = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n - 1}} = \sqrt{\frac{\sum_i f_i (x_i - \bar{x})^2}{n - 1}}$$

1. (18pts) Over the course of two weeks (workdays only) DMV employee Jonathan counts the daily number of people coming to take the driving test. He gets the following numbers: 8, 7, 4, 11, 10, 9, 9, 10, 7, 6.

- Find the midrange.
- Find the median.
- Find the mean.
- Find the range.
- Find the standard deviation.

$$a) \frac{4+11}{2} = 7.5$$

b) 4, 6, 7, 7, 8, 9, 9, 10, 10, 11

↑  
middle two

$$\frac{8+9}{2} = \frac{17}{2} = 8.5$$

$$c) \bar{x} = \frac{4+6+7+7+10+11}{10} = \frac{81}{10} = 8.1$$

$$d) \text{range} = 11 - 4 = 7$$

$$e) (4-8.1)^2 + (6-8.1)^2 + 2 \cdot (7-8.1)^2 + (8-8.1)^2 + 2 \cdot (9-8.1)^2 + 2 \cdot (10-8.1)^2 + (11-8.1)^2 = 40.9$$

$$s = \sqrt{\frac{40.9}{10-1}} = \sqrt{\frac{40.9}{9}} = 2.131770$$

2. (8pts) A downtown beautification project is proposed for Murray's downtown, paid for by taxpayer money. To gauge support for the idea, city officials decide to do a survey of the city's population. Comment on whether each of the following methods will produce a good random sample of the city's population:

- Surveying passers-by on the court square.
- Surveying people who have come to see a basketball game at the CFSB center.
- Picking random names from the list of people who pay property taxes in Murray, and surveying them.
- Surveying patrons of Murray's Backyard Burger.

a) Not a good sample - may be biased toward beautification, since they likely pass there often.

b) Not a good sample - contains many people from out-of-town

c) A reasonably good sample, since they are the ones who will likely pay for it

d) Not a good sample - B.B. appears to cater mostly to younger people, rather than a broad section of the population.

3. (25pts) A fashion magazine assistant editor does not want to repeat the clothes she wears too often and has her assistant keep track of how often she wore each of her garments over a period of time. The table below indicates how many times she wore those garments (she wore 18 garments once, 14 garments twice, etc.). Note that "times worn" is the data, the other numbers are frequencies.

- Draw a histogram for the data.
- Find the mode number of times worn.
- Find the median number of times worn.
- Find the mean number of times worn.
- Find the standard deviation.

Times worn	Frequency (garments)
1	18
2	14
3	10
4	17
5	6
	65



h) mode is 1 (occurs most frequently)

c)  $\overbrace{1, \dots, 1}^{18}$ ,  $\overbrace{2, \dots, 2}^{14}$ ,  $\overbrace{3, \dots, 3}^{10}$ ,  $\overbrace{4, \dots, 4}^{17}$ ,  $\overbrace{5, \dots, 5}^6$   
 18th, 32nd, 33rd

$\frac{65}{2} = 32.5$ , need 33rd item in list

median = 3

$$d) \bar{x} = \frac{1 \cdot 18 + 2 \cdot 14 + 3 \cdot 10 + 4 \cdot 17 + 5 \cdot 6}{18 + 14 + 10 + 17 + 6}$$

$$= \frac{174}{65} = 2.676923$$

$$e) 18(1 - 2.67\overline{6})^2 + 14(2 - 2.67\overline{6})^2$$

$$+ 10(3 - 2.67\overline{6})^2 + 17(4 - 2.67\overline{6})^2$$

$$+ 6(5 - 2.67\overline{6})^2 = 120.21\overline{6}$$

$$s = \sqrt{\frac{120.21\overline{6}}{65 - 1}} = \sqrt{\frac{120.21\overline{6}}{64}} = 1.370534$$

4. (6pts) In a normal distribution with mean 15 and standard deviation 2.1, which data value is

a) 2 standard deviations above the mean?  $x = 15 + 2 \cdot 2.1 = 19.2$

b) 1.5 standard deviations below the mean?  $x = 15 - 1.5 \cdot 2.1 = 11.85$

5. (14pts) The scores on exam 2 of a College Algebra class are shown below.

a) Construct a grouped frequency distribution whose first class is 50-59.

b) Enter a representative value for each interval.

c) Use the representative values to estimate the mean of data. How does it compare to the actual mean of 79.8? (Do not compute the actual mean.)

91, 109, 83, 92, 68, 75, 74, 86, 84, 69, 83, 65, 92, 69, 76, 100, 89, 74, 53, 64, 78, 67, 73, 101, 78, 72, 58, 74, 96, 59, 102, 71, 85, 64, 77, 96, 107

Range of Scores	Frequency	Representative Value
50-59	3	54.5 = $\frac{50+59}{2}$
60-69	7	64.5
70-79	11	74.5
80-89	6	84.5
90-99	5	94.5
100-109	5	104.5
	37	

$$\bar{x} \approx \frac{3 \cdot 54.5 + 7 \cdot 64.5 + \dots + 5 \cdot 104.5}{3 + 7 + 11 + \dots + 5 + 5} = \frac{2936.5}{37} = 79.364865$$

pretty close to actual mean.

6. (12pts) Assume the speed of vehicles on highway 641 in the afternoon is normally distributed with mean of 59mph and standard deviation 4mph. Use the 68-95-99.7 rule (draw a picture) to find the percentage of drivers whose speed is:

a) between 59 and 63

$$A(59 \leq X \leq 63) = \frac{0.68}{2} = 0.34, \quad 34\%$$

b) under 51

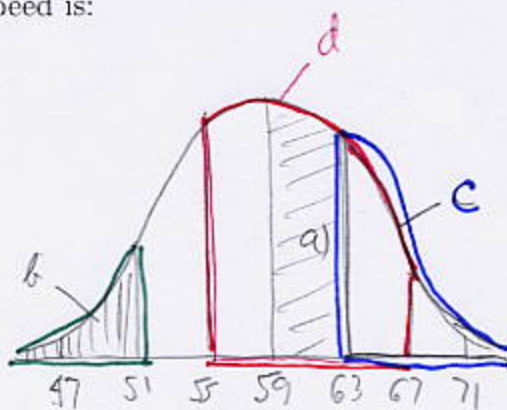
$$A(X \leq 51) = 0.5 - \frac{0.95}{2} = 0.025, \quad 2.5\%$$

c) over 63

$$A(X \geq 63) = 0.5 - \frac{0.68}{2} = 0.16, \quad 16\%$$

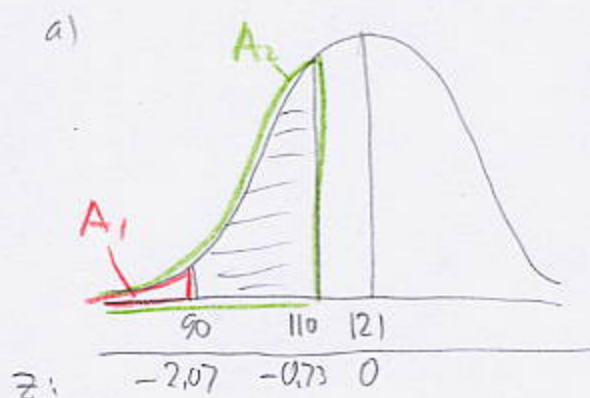
d) between 55 and 67

$$A(55 \leq X \leq 67) = \frac{0.68}{2} + \frac{0.95}{2} = 0.34 + 0.475 = 0.815, \quad 81.5\%$$



7. (17pts) Systolic blood pressure readings are normally distributed with a mean of 121 and a standard deviation of 15. Draw a picture showing which area you are computing as you answer:

- a) What percentage of people have systolic blood pressure between 90 and 110?  
 b) What percentage of people have systolic blood pressure higher than 140 (which is considered high blood pressure)?



$$\frac{90-121}{15} = -2.07$$

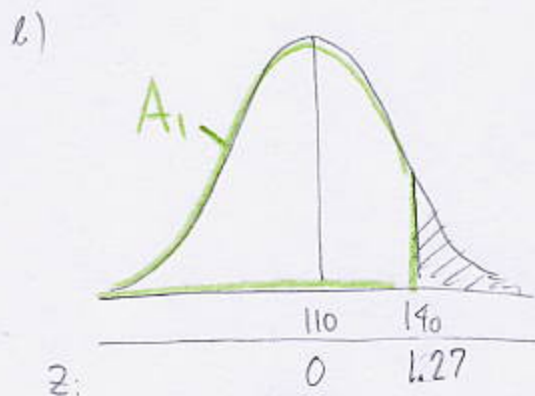
$$\frac{110-121}{15} = -0.73$$

$$A(-2.07 \leq z \leq -0.73)$$

$$= A_2 - A_1$$

$$= 0.2327 - 0.0192$$

$$= 0.2135 \quad 21.35\%$$



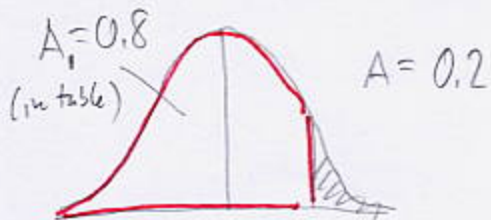
$$\frac{140-121}{15} = 1.266 \approx 1.27$$

$$A(z \geq 1.27) = 1 - A_1$$

$$= 1 - 0.8980$$

$$= 0.1020, 10.2\%$$

**Bonus.** (10pts) A woman insists she will never marry a man shorter than she is, even though she knows only 20% of men fall into this category. If men's heights are normally distributed with mean 69 inches and standard deviation 2.5 inches, how tall is the woman? (Hint: this problem is the reverse of what we usually do with a normal distribution. Here, the area is given: you have to find the z-score that this area corresponds to. You will also need to find the height corresponding to that z-score.)



Need  $z$  corresponding to 0.8  
 0.7995 is closest number in table to 0.8,  
 $z = 0.84$  corresponds to it.

$$x = 69 + 0.84 \cdot 2.5$$

$$= 71.1 \text{ inches}$$

Woman is 71.1 inches tall.