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JOHNS HOPKINS  
BLOOMBERG  
SCHOOL *of* PUBLIC HEALTH

## Lecture 1c: Practice Problem Solutions

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## Practice Problems

1. The following data is the annual income (in \$1,000s of U.S. dollars) taken from nine students in the Hopkins internet-based MPH program:

37 102 34 12 111 56 72 17 33

## Practice Problems

a) Calculate the sample mean income

- Where  $n = 9$  and  $x_1$  through  $x_9$  represent the nine observed values of income:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

- In this sample:

$$\bar{x} = \frac{37 + 102 + 34 + 12 + 111 + 56 + 72 + 17 + 33}{9}$$

$$= \frac{474}{9} \approx 52.7 \text{ (the sample mean income is \$52,700)}$$

## Practice Problems

b) Calculate the sample median income

- To calculate the sample median, we must first order our data from the lowest value to the highest value

12 17 33 34 37 56 72 102 111

- Since there are nine observations, the median is the value directly in the center: the 5th ranked observation

12 17 33 34 **37** 56 72 102 111

- The sample median income is \$37,000

## Practice Problems

- c) Calculate the sample standard deviation of these incomes.
- In this sample of nine observations, the formula for the SD is:

$$s = \sqrt{\frac{\sum_{i=1}^9 (x_i - \bar{x})^2}{8}}$$

- Now:

$$\frac{\sum_{i=1}^9 (x_i - \bar{x})^2}{8} = \frac{(37 - 52.7)^2 + (102 - 52.7)^2 + \dots + (33 - 52.7)^2}{8}$$
$$\approx \frac{10,128}{8}$$

## Practice Problems

c) So:

$$s = \sqrt{\frac{\sum_{i=1}^9 (x_i - \bar{x})^2}{8}} = \sqrt{\frac{10,128}{8}} = \sqrt{1,267} \approx 35.6$$

- The sample standard deviation is \$35,600: on average, each of the nine observed incomes falls about \$35,600 away from the sample mean (above or below)

## Practice Problems

- d) What population could this sample represent?
  - It could be representative of the population of all Johns Hopkins Internet-based MPH students



## Practice Problems

- e) Which would change by a larger amount—the mean or median—if the 34 were replaced by 17, and the 12 replaced by a 31?
  - Notice that both changes do nothing to change the position of the median; therefore, the only statistic of the two that would change is the mean (the sample standard deviation would also change)

## Practice Problems

2. The following data shows birthweights (oz) from seven consecutive deliveries at the Johns Hopkins Hospital

121 138 32 100 58 64 146

# Practice Problems

- a) Calculate the sample mean birthweight
- b) Calculate the sample median birthweight
- c) Calculate the sample standard deviation of these birthweight
  - I'm using Stata to do the first three questions!
  - Data in Stata:

```
. list  
  
      +-----+  
      |  bw  |  
      |-----|  
1.   | 121 |  
2.   | 138 |  
3.   |  32 |  
4.   | 100 |  
5.   |  58 |  
      |-----|  
6.   |  64 |  
7.   | 146 |  
      +-----+
```

# Practice Problems

- Calculate the sample mean birthweight
- Calculate the sample median birthweight
- Calculate the sample standard deviation of these birthweight
  - summarize* command with *detail* option

```
. summarize bw, detail
```

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Percentiles		Smallest	
1%	32	32	
5%	32	58	
10%	32	64	Obs 7
25%	58	100	Sum of Wgt. 7
50%	100		Mean 94.14286
		Largest	Std. Dev. 43.67466
75%	138	100	Variance 1907.476
90%	146	121	Skewness -.1538512
95%	146	138	Kurtosis 1.544331
99%	146	146	

## Practice Problems

- d) What population could this sample represent?
- This could possibly be representative of all births in a fixed time period (one month, one year?) at Johns Hopkins hospital, and possibly other U.S. urban teaching hospital
  - However, we may want to ask a few questions of the researcher who collected this data before making this conclusion

## Practice Problems

- e) Suppose this is a representative sample of births in a given year at Johns Hopkins
- Suppose, instead of a sample of seven values, we have a sample of 100 birthweights
  - How should the mean, median and standard deviation of this sample compare to the same statistics for the sample of seven birthweights?
  - **Answer:** The mean, median and SD from the sample of 100 will likely not equal their counterparts from the sample of seven
  - However, all should be “similar” in value
  - There is no way to ascertain how each of these will differ across the samples (i.e., which sample would have the larger sample mean, etc.)