**FORMULAS:**

NORMAL DISTRIBUTION

  

SAMPLING DISTRIBUTION OF THE MEAN

  

**Statistics Essentials Normal Distribution:** Know: 1) the characteristics of a standard normal distribution; 2) how to identify a probability distribution; 3) find an area associated with a z-score (use the standard normal table); 4) find a z-score associated with an area (use the standard normal table); and 5) determine the probability of occurrence specified by an area under the standard normal curve

**Statistics Essentials Distribution of the Sample Means:** Know: 1) the characteristics of the distribution of sample means; 2) the Central Limit Theorem. **[NOTE: see Orange sheets for additional problems and resources.]**

**PROBLEMS:**

1. Identify the characteristics of the standard normal distribution

 = 0; = 1; symmetric; area under curve = 1; extends from -∞ to +∞; curve never touches baseline

1. Using the standard normal, find the following probabilities:
   1. P(2.33<z<2.36) = .9909 - .990 = **.0008**
   2. P(-2.33<z<3.20) = .9993 - .0099 = **.984**
2. Using the standard normal, find the z-scores associated with the following areas:
   1. .8834 =>**1.19**
   2. .4912 => **0.02**
3. Engineer’s salaries: According to the U.S. Census Bureau, students in their first year after graduating with bachelor’s degrees in engineering earned an average salary of $3189 per month. Assume that this distribution is normal with a mean of 3189 and standard deviation of 600. What proportion of salaries lie between $3789 and $4389? [Larose; 283]

 Corresponding area for z=1 is **.8413**

 Corresponding area for z=2 is **.9772**

P(3789<x<4389)=.9772-.8413=**.1359**

1. Check your blood pressure: In a recent study, the Centers for Disease Control and Prevention reported that diastolic blood pressures for adult women in the United States are approximately normally distributed with mean 80.5 and standard deviation 9.9.
2. What proportion of women have blood pressures lower than 70?
3. What proportion of women have blood pressures between 75 and 90?
4. A diastolic blood pressure greater than 90 is classified as hypertension (high blood pressure). What proportion of women have hypertension?
5. Is it unusual for women to have a blood pressure lower than 65?

[Navidi; page 249]

a)  Corresponding area for z=-1.06 is .1446 P(x<70)=.1446

b)  Corresponding area for z=-.56 is .2877

 Corresponding area for z=.96 is .8315

P(75<x<90)=.8315-.2877=.5438

c)  Corresponding area for z=.96 is .8315

P(x>90)=1-.8315=.1685

d)  No, it would not be unusual because this value is within two standard deviations of the mean.

1. Stock Shares Traded: The average number of shares traded on the New York Stock Exchange in June 2004 was 2.4 billion per day. Assume that the distribution of shares traded is normal with a mean of 2.4 (in billions of shares) and a standard deviation of 0.6 (in billions of shares). What is the probability that between 1.8 billion and 2.4 billion shares were traded?

Larose; 283]

 Corresponding area is **.1587**

 Corresponding area is .5

**P(1.8<x<2.4)=.3413**

1. Hungry babies: Six-week-old babies consume a mean of 15 oz. of milk per day, with a standard deviation of 2 oz. Assume that the distribution is normal.
2. Find the probability that a randomly chosen baby consumes between 17 and 19 oz. of milk per day.
3. Find the probability that a randomly selected baby consumes less than 11 oz. of milk per day.

[Larose; 310]

1. Find the probability that a random sample of 25 babies will consume less than 11 oz. of milk per day.
2. Which is more likely, one baby consuming less than 11 oz. of milk or a sample of 25 babies drinking less than 11 oz. of milk? In terms of sampling, what does this imply?
3. For samples of size 25, determine the mean and standard deviation of all possible sample means.
4. For samples of size 50, determine the mean and standard deviation of all possible sample means.
5. What value of milk consumption would separate the bottom 10% of babies from all others?

a)  Corresponding area is .8413

 Corresponding area is .9772 P(17<x<19)=.9772-.8413=.1359

b)  Corresponding area is .0228 P(x<11)=.0228

c)  Probability is essentially 0.

d) One baby. What this suggests is that as the sample size increases, the likelihood of getting extreme results decreases. Conversely, the likelihood of getting a value reflecting the true mean increases.

e) Mean:  Std. Dev: 

f) Mean:  Std. Dev: 

g)  Hold it, where did that -1.28 come from??? Every z has an area; every area has a z. So, an area of .10 (the 10%) is a value in the body of the standard normal table. Find the tabled value closest to it and get its associated z value, here it equals -1..28.

1. Median Household Income: The Census Bureau reports that the median household income was $48,201 in 2006. Assume that the distribution of income is normal with a mean of $48,201 and a standard deviation of $16,000.

[Larose; 283]

1. Find the probability that a randomly selected household has an income greater than $80,201.
2. Find the probability that a randomly selected sample of 75 household have an income greater than $80,201.
3. For samples of size 75, determine the mean and standard deviation of all possible sample means.
4. What value of household income would separate the top 1.5% of from all others?
5.  Corresponding area for z=2 is .9772

P(x>80201)=1-.9772=.0228

1. Probability is essentially 0
2. Mean:  Std. Dev: 
3. How did I get a value of 2.17? Every area has an associated z. Here 1.5% converts to .015. The highest incomes are to the right, so 1-.015 = .9850. Find that in the middle of the standard normal table and the associated z-value is 2.17.