**Final Exam – IT223**March 17, 2010

**Part A. Multiple Choice Questions.** For each question, you are encouraged to give a reason or show work for partial credit. You must show your work if the question is marked with an asterisk (\*). Questions 6, 7, 9 through 15 require you to show a reason or work**.** Answer all 15 questions.

1. What is a sample space for a statistical experience? It is the set of all  
   a. events. b. outcomes. c. null hypotheses. d. successes.
2. In 1817, Jakob Bernoulli   
   a. proved the Central Limit Theorem.  
   b. proved the Law of Large Numbers.  
   c. stated the Central Limit Theorem.  
   d. stated the Law of Large Numbers.
3. In 1901, Alexandr Lyapunov   
   a. proved the Central Limit Theorem.  
   b. proved the Law of Large Numbers.  
   c. stated the Central Limit Theorem.  
   d. stated the Law of Large Numbers.
4. Which term best describes probabilities assigned to non-repeatable events?  
   a. Theoretical b. Subjective c. Empirical d. Bernoulli Trials
5. What is the expected value of a random variable?  
   a. Impossible to calculate because the outcomes of the random variable are unpredictable.  
   b. The average of a very large number of outcomes of the random variable.  
   c. The difference of the maximum and minimum outcomes of the random variable.  
   d. The variance of the outcomes of the random variables.
6. \*Suppose that the probability that the Cubs will win the World Series in 2010 is 10%, If the Cubs do not win the World Series, you give me $20. If the Cubs win the World Series, how much would you need to win from me to make this a fair bet?  
   a. $20 b. $180 c. $200 d. $2,000
7. \*Find the theoretical SD of the random variable defined by this probability distribution:

|  |  |
| --- | --- |
| Outcome | Probability |
| 3 | 1/3 |
| 6 | 2/3 |

a. 0.471 b. 1.333 c. 1.414 d. 2.000

1. What is zero factorial (0!)?  
   a. 0 b. 1 c. Infinity d. Undefined
2. \*A basketball player is known to be a 90% free throw shooter. What is the probability  
   that she misses at least one free throw out of ten tries? Assume that the free throws are  
   Bernoulli trials.  
   a. 10.0% b. 41.0% c. 65.1% d. 100%
3. \*A basketball player is known to be a 90% free throw shooter. What is the probability that she shoots 5 out of 7 free throws in a game? Assume that the free throws are  
   Bernoulli trials.  
   a. 2.30% b. 6.54% c. 13.71% d. 51.43%
4. \*A basketball player is known to be a 90% free throw shooter. What is the probability that she shoots 270 or better out of 300 for the season? (Use 269.5.) Use the Central Limit Theorem to approximate this. Assume that the free throws are Bernoulli trials.  
   a. 9.4% b. 50.0% c. 50.4% d. 61.4%
5. \*From the ideal measurement model xi = µ + ei, a random sample with is collected. Here are the results:   
    n = 9 x = 4.62 SD+ = 1.45  
   What is the standard error of x?  
   a. 0.161 b. 0.483 b. 0.547 d. 1.64
6. \*A representative sample of 9000 persons are each asked the question “Do you have a favorable opinion of Government Official X. 3948 persons answer yes. Find a 95% confidence interval for the true number of people that have a favorable opinion of Government Official X.   
   a. (40.9%, 46.9%) b. (42.0%, 58.0%) c. (42.8%, 44.9%) d. (43.9%, 43.9%)
7. \*Perform a one-sample t-test using the following statistics:   
    n = 5 x = 3.871 SD+ = 0.679.  
   The null hypothesis is μ = 5.0 is   
   a. accepted at the 5% level; accepted at the 1% level.  
   b. accepted at the 5% level; rejected at the 1% level.  
   c. rejected at the 5% level; accepted at the 1% level.  
   d. rejected at the 5% level; rejected at the 1% level.
8. \*If SD1 = 8.0, n1 = 400, SD2 = 9.0, and n2 = 900, what is the SDdiff?  
   a. 0.25 b. 0.50 c. 1.20 d. 12.04

**Part B. Regression Problem.** The height (x-variable) and weight (y-variable) of a population of female models are recorded and descriptive statistics are computed:  
  
 x = 1.7 SDx = 0.05m y = 50kg SDy = 5kg r = 0.8  
  
Assume that the heights and weights for the population are bivariate normal.

1. About what percentage of the models have weights over 58 kg.
2. Find the regression line for predicting weight from height.
3. What is the predicted weight score for a model that has a height of 1.8m?
4. Of the models that have a height close to 1.8m, what percentage of them have weights over 58kg?

**Part C: Short Essay**  
1. Explain what a statistical test of hypothesis is to someone that does not understand statistics.  
 You may wish to discuss some of the following questions. For full credit, write in complete   
 sentences and include an introduction and a conclusion.   
  
 a. Why are hypothesis tests important in modern science?  
 b. What are the main parts of a hypothesis test?  
 c. What does it mean to accept the null hypothesis?  
 d. What is the difference between statistical significance and importance?  
**Part D. Hypothesis tests using SPSS.**

1. **Paired-sample t-test.** The SPSS output is entitled “Part D1: Paired-samples t-test SPSS Output.”  
     
   A random sample of 8 persons are weighed before they start a diet. They are on the medically supervised diet for eight weeks and then weighed again. The data is on Page 1 of the SPSS output.   
     
   a. Are the before weights normally distributed? Are the after weights normally   
    distributed? Why?  
     
   b. Use the SPSS output to perform a hypothesis test to determine whether the after   
    weights are significantly different than the before weights. Explain your answer.
2. **Independent Two-sample t-test.** The SPSS output is entitled “Part D2: Independent Two-sample t-test SPSS Output.”  
     
   A technician wants to determine if the average weights of screws manufactured by Machine 1 is the same as the average weights of screws from Machine 2. The collected data is on Page 1 of the SPSS output.  
     
   a. Are the data normally distributed for each machine? Why?  
     
   b. Use the SPSS output to perform a hypothesis test to determine whether the weights of   
    the screws are different for Machine 1 and Machine 2. Explain your answer.