K300 (4392) Statistical Techniques (Fall 2007)

Assignment 3: Probability (Due October 1)

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Please read the following instructions carefully to do this homework (120 points) successfully.

- You MAY NOT use a wordprocessor (e.g., Microsoft Word and WordPerfect); **Use separate sheets and write down answers by hand.**
- Answer all questions. Do not skip any one.
- Show how you obtain the answers. In most questions, a single number may not be accepted as the answer.
- Once you finish, print out your assignment; put it into an envelope; and then hand in on Monday, October 1.
- **Deadline and late penalty are strictly applied** as described in the syllabus. Do not wait until the last minute. Hurry up to meet the deadline.
- You MAY NOT discuss with other classmates when answering questions.

If you have any problem with any of the questions, please email the instructor or come and see the instructor during office hour MW 2:00-3:00 P.M. Or you may make an appointment with the instructor.

1. (2 points) Identify the sample space for tossing a coin four times. The coin is fair so that we have 50-50 percent chance of getting head or tail. You may use (but do not report) a tree diagram described in Example 4-4 on page 181. *See page 179-180*.

2. (5 points) Using the sample space you identified in question 1 above, find the following probabilities. These are classical probabilities. *See page 182-185*.

1) Probability of getting all head.
2) Probability of getting all tail.
3) Probability of getting two heads and two tail.
4) Probability of getting three tails and one head.
5) Probability of landing on its edge (neither head nor tail).

3. (5 points) Solve question 15 on page 192. You MUST show how you get the answers. Do not simply copy the answers in the textbook. In addition, find the probability that the customer get neither money nor a coupon (2 points). *See page 185-187*.

4. (10 points) Solve question 40 on page 194. You MUST show how you get the answers. Do not forget to find the sample space such as (0, 0), (0, 1)… Odd numbers are 1 and 3, while even numbers are 0, 2, and 4. Identify all relevant outcomes first.

5. (5 points) Determine whether two events are mutually exclusive. *See pages 195-197 and question 2 on page 199*.

1) Rolling a die: get a prime number (2, 3, 5) and get an even number.
2) A student is a junior and a student is a girl student.
3) A student registers K300 and a student takes a public management course.
4) Indianapolis Colts beat Jacksonville Jaguars and Jaguars beat Colts on October 22
5) You watch a movie and drink a coke.

6. (5 points) See the car information in question 13 on page 200. Find 1) probability that you select a domestic or compact car; 2) probability that you select a foreign SUV; 3) probability that you select a foreign or SUV; 4) probability that you select a compact or mid-size car; 5) probability that you select a foreign or domestic car. Show how you get the answers. *See pages 197-198*.

7. (3 points) See the example 4-25 on pages 206-207. Note that a ball selected is replaced. Find 1) probability that you select 2 red balls; 2) probability that you select 1 white ball and then 1 red ball; 3) probability that you select 1 blue and then 1 red ball. *See pages 64-65*.

8. (2 points) Solve question 6 on page 215 by changing prison inmates selected from 2 to 3. Show how you get the answer. *See 205-208*.

9. (2 points) Solve question 13 on page 215. Select 3 children instead of 4. Show how you get the answer. *See 205-208*.

10. (5 points) Solve question 35 on page 217. Show how you get the answer. You should use the formula on page 210.

11. (2 points) Solve question 27 on page 216. Show how you get the answer. *See 210-212*.

12. (5 points) See example 4-34 on pages 211-212. Find 1) the probability that the respondent answered no, given that the respondent was a male; 2) the probability that the respondent was a male, given that the respondent answered no. 3) Do you have the same probability in 1) and 2)? *See pages 210-211*.

13. (5 points) Solve question 32 on page 216. Show how you get the answer. Suppose that 70 percent of the customers order salad. Do you think ordering pizza and salad are statistically independent events? *See 208, 210-212*.

14. (10 points) According to the Statistical Abstract of the United States, 70 percent of females age 20 to 24 have never been married. Let us call this event S. Event M is that females have been married at least once. 1) Compute P(M) + P(S). Are events S and M mutually exclusive? Why? 2) Compute P(M|S), the conditional probability of M given S. 3) Show whether events S and M are statistically independent. Are they statistically independent? Do not simply answer as yes or no. *See question 37 on page 217 and question 53 on page 218*.

15 (2 points) Solve question 34 on page 236. In addition, find the number of options if an employee selects two health care plans and one retirement plans without expense accounts. Show your work using formula. *See 229-231*.

16 (10 points) Solve question 10 on page 233. Show your work using formula. Fractions such as 1/91 and 5/9 will do for your answers. *See 229-230*.

17 (5 points) Solve question 35 on page 239. Show your work. You may take advantage of complementary probability, which asks the probability that a person does not suffer from a heart attack. *See 229-231*.

18 (5 points) Let *x* the number of heads you get when tossing a fair coin four times. 1) Construct a table for this probability distribution. The first row is labeled as "x" and the second row as "P(x)". Note you have five outcomes, 0 through 4. And then 2) compute the expected value and variance of *x*. *See 251-254, 266*.

19 (2 points) Solve question 9 on page 259. Show your work. *See 251-254*.

20 (5 points) See example 5-16 on pages 264-265. 1) Find the probability that exactly 2 people visited a doctor last month. You may take advantage of the binomial distribution talbe on pages 626-627 to get the probability. 2) What is the probability that less than 4 people (none, 1, 2, and 3) have visited a doctor. 3) compute the expected value and variance of this probability distribution. *See 263-264 and 266-267*.

21 (5 points) Solve question 10 on page 269. In addition, find the probability when the fraud rate is changed from .6 to .7. Is this event likely? *See 263-264.*

22 (5 points) See question 5 on page 269. Let us assume that the probability that a student know a correct answer is .70 instead of .50, and that this probability does not change across questions. Yes, this is a strong assumption. A student will pass the exam when he misses fewer than 2 questions (none or only one) out of the total 10. What is the probability that a student passes this exam? Is it likely? You may take advantage of the complementary probability, which is the probability that a student misses none or one question. *See 263-264.*

23 (5 points) Solve question 20 on page 270 by changing the seating capacity from 80 to 100. In addition, find the probability that at least 2 out of 10 randomly select patrons will smoke. You may take advantage of the complementary probability. *See 263-264.*

24 (10 points) Indiana Pacers won 35 games out of 82 games last season. The winning rate is about .4. One of your friends insists that Pacers become much powerful this season and will win at least 6 games (6 and 7) among the first 7 games. You are stroked by the binomial distribution we discussed and decide to show how likely his forecast is. 1) Provide N (the number of trials), r (the number of wins), p(probability of wining a game), and q(probability of losing a game); 2) compute probability that Pacers win at least 6 out of the first 7 games; 3) Is his forecast likely? Based on this result, what would you tell your friend? 4) (5 points) Now, you get to remember the key features of a binomial experiment that the Instructor emphasized. For example, the outcomes of each trial must be independent of each others and the probability of success must remain the same for each trial. Is there any problem in your reasoning about forecasting the likelihood? Is the winning rate of .4 still valid for this season? If yes, explain why and how your reasoning is problematic. Otherwise, defend your reasoning and interpretation.