

Nipissing University  
Department of Computer Science & Mathematics  
**MATH 2076 - Probability & Statistics I**  
Instructor: Dr. Tzvetalin S. Vassilev

Time: 120 minutes

**Sample Midterm Examination**

February 14, 2011

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CLOSED BOOK. SHOW YOUR WORK.

*All questions are of equal value.*

1. (a) State and prove the Bayes' Rule.  
(b) Two methods,  $A$  and  $B$ , are available for teaching a certain industrial skill. The failure rate is 20% for  $A$  and 10% for  $B$ . However,  $B$  is more expensive and hence is used only 30% of the time. ( $A$  is used the other 70%.) A worker was taught the skill by one of the methods but failed to learn it correctly. What is the probability the she was taught by method  $A$ ?
2. (a) Define conditional probability of an event. State the definition of independent events.  
(b) Suppose that  $A$  and  $B$  are mutually exclusive events, with  $P(A) > 0$  and  $P(B) < 1$ . Are  $A$  and  $B$  independent? Prove your answer.
3. (a) Derive the formula for the number of partitions of a set containing  $n$  distinct elements into  $k$  subsets containing  $n_1, n_2, \dots, n_k$  elements, respectively.  
(b) A local fraternity is conducting a raffle where 50 tickets are to be sold – one per customer. Three prizes are to be awarded. If the four organizers of the raffle each buy one ticket, what is the probability that the four organizers win
  - all of the prizes?
  - exactly two of the prizes?
  - exactly one of the prizes?
  - none of the prizes?
4. (a) Define binomial experiment. Explain in detail when a discrete random variable has binomial distribution.  
(b) A manufacturer of floor wax has developed two new brands,  $A$  and  $B$ , which she wishes to subject to homeowner's evaluation to determine which of the two is superior. Both waxes,  $A$  and  $B$ , are applied to floor surfaces in each of 15 homes. Assume that there is actually no difference in the quality of the brands. What is the probability that ten or more homeowners would state a preference for brand  $A$ ?
5. (a) Define the geometric probability distribution. Derive its mean and standard deviation.  
(b) Given that we have already tossed a balanced coin ten times and obtained zero heads, what is the probability that we must toss it at least two more times to obtain the first head?

The End