Name: _____

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ISyE 3027
Test 1

1. The set S of all possible outcomes is called the _____. An
_____E is a subset of this set and has an associated number
$P(E)$ which represents it's _____of occurring. These numbers
have to satisfy three axioms: $P(S) = 1$, $0 \leq P(S)$, and _____.
Random variables are _____from S to the real line.

[30]

[30] 2. Suppose $P(A) = .4$, $P(B) = .3$, and $P(B \mid A) = .5$. What are

   (a) $P(\bar{A})$?

   (b) $P(A \cap B)$?

   (c) $P(A \cup B)$?

   (d) $P(A \mid B)$?

   (e) $P(B \mid \bar{A})$?

3. Suppose $S = \{a, b, c\}$, $P(a) = 2/10$, $P(b) = 3/10$, $X(a) = 3$, $X(b) = 5$,
[30] $X(c) = 2$, $Y(a) = 4$, $Y(b) = 1$, $Y(c) = 4$, and $Z = X + Y$. What are

   (a) $\Pr\{X = 3\}$?

   (b) $\Pr\{X < 4\}$?

   (c) $\Pr\{Y = 4, X = 2\}$?

   (d) the probability mass function of Y?

   (e) the probability mass function of Z?

4. Some important distributions are: Bernoulli, exponential, geometric, bi-
   nomial, hypergeometric, Poisson, uniform, Erlang, gamma, beta, normal,
   and chi-squared (some of these are "red herrings"). What would be the
   most reasonable guess for each of the following situations (give the sim-
[30]   plest that seems appropriate)?

   (a) Whether or not there is a fire in Atlanta tomorrow.

   (b) The number of days next week that have fires in Atlanta.

   (c) The number of days next week that have two or more fires in Atlanta.

   (d) The number of days until there is a day with no fires in Atlanta.

   (e) The number of fires next week in Atlanta.

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5. There are 3 garbage cans. Garbage can #1 is selected with probability 1/10 and contains 5 red marbles. Garbage can #2 is selected with probability 3/10 and contains 7 green marbles. Garbage can #3 is selected with probability 6/10 and contains 3 red and 4 green marbles. A garbage can is selected according to the specified probabilities and a marble is selected at random from that garbage can. Let A_i denote the event that garbage can i was selected. Let B denote the event that a red marble was selected.

[30]

   (a) Compute $P(B)$.

   (b) Compute $P(A_1 \mid B)$.

6. Suppose you are dealt 7 cards at random from a standard 52 card deck. In the following questions, do not simplify your answer. Leave it in terms of factorials or ().

[30]

   (a) What is the probability of a full house, i.e., 3 of one rank, two from another rank, and 2 other cards from 2 other ranks?

   (b) What is the probability of 2 triples, i.e. 3 of one rank, 3 of another rank, and 1 card from some other rank?

7. Prove or disprove: If the sample mode and sample mean are equal, then the sample median and the sample mean are equal.

[30]

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8. Bonus: How did the term "red herring" arise?