

Statistics 435, Sample Questions  
First Midterm Exam

**Problem 1.** A probability space contains two events  $A$  and  $B$  such that  $P(A) = .20$ ,  $P(B) = .40$ , and  $P(A \cap B) = .10$ . Find the following.

- a.  $P(A^c)$
- b.  $P(A \cup B)$
- c.  $P(A^c \cup B^c)$

If  $C$  is a third event such that  $P(C) = .30$  and  $C \cap A = \emptyset$ , find  $P(C \cup (A \cap B))$ .

**Problem 2.** Consider an experiment in which successive Bernoulli trials are performed until the first success occurs. Assume that for each trial  $Pr(S) = p$  and  $Pr(F) = q$ .

Describe the set of possible outcomes  $\Omega$  and find the probability of each outcome. Show that these probabilities sum to one.

**Problem 3.** An urn contains 10 physically identical balls, numbered  $1, 2, \dots, 10$ . Consider the following experiments, in which balls are sampled from the urn.

A. If we draw five balls at random from the urn, replacing the ball after each draw, what is the probability that we see 3 even numbers.

B. Suppose that we select a random subset of five balls from the urn. Find the probability of the following events.

- i. Every number in the sample is greater than 3.
- ii. The sample contains three even and two odd numbers.
- iii. The sample contains at least one number greater than or equal to 8.



**Problem 5:** A toy manufacturer makes red and blue marbles, which are sold in packages of five. Suppose that the color composition of the packages is distributed as follows.

50% of packages have all blue marbles

30% of packages have 3 blue and 2 red marbles

20% of packages have 1 blue and 4 red marbles

Suppose that you choose a package of marbles at random from the manufacturer's warehouse. Unaware of the contents of the package, you select one of the five marbles at random.

a. What is the probability that you select a blue marble?

Answer:\_\_\_\_\_.

b. Given that you selected a blue marble, what is the probability that all the other marbles in the package are blue?

Answer:\_\_\_\_\_.