

*Follow these instructions carefully:*

Work on the paper provided; do not use your own paper. *Work only on one problem on each sheet (you should not work on two different problems on the two sides of the same sheet).* On the top of each page, *print* your name (*encircle your last name*) and indicate the number of the problem you are working on by writing e.g. “*Problem #4*”. Always *encircle* your final answer. If there are several parts to a problem, always indicate the part that you are answering, e.g. by writing “*Answer to Part b*” (the number of the problem should be on the top of the page). Do not use a *red* pen or a *red* pencil. Do not write in the corner covered up by the staple (top left corner on the front side, top right corner on the back side). Each problem is worth the *same* amount of credit. **Show all your work.**

1. Let  $A$  and  $B$  be two events such that  $P(A) = .4$ ,  $P(B) = .5$ , and  $P(A \cap B) = .3$ .

- a) Find  $P(A \cup B)$ .
- b) Find  $P(A \setminus B)$ .

2.a) From an urn containing 10 red balls and 6 green balls, five balls are taken without replacement. Determine the probability that 2 of the balls are red and 3 of them are green.

b) Give the probability if the same experiment is performed with replacement, and the same outcome is obtained.

3.a) In a factory, parts are manufactured by three machines,  $M_1$ ,  $M_2$ , and  $M_3$  in proportions 10 : 30 : 60. The percentages 4%, 7%, and 3% of these parts are defective, respectively. Find the probability that a randomly chosen part is defective.

b) Find the probability that a defective part was manufactured on the third machine.

4. Three hunters shoot at the same deer simultaneously. They hit or miss independently of each other. The first hunter hits with probability  $1/3$ , the second one with probability  $1/4$ , and the third one with probability  $1/5$ . Calculate the probability that the deer will be hit at least once. *Hint:* Consider the complement of the event in question, that is, the event that no hunter will hit the deer.

5.a) From an urn with 15 red balls and 5 green balls, one ball is drawn with replacement until a green ball is obtained. Let  $X$  be a random variable whose value is the number of tries for a green ball to be drawn. Find the distribution of  $X$ ; that is, find the probability that  $X = k$  ( $k = 1, 2, 3, \dots$ ).

b) Find the probability  $P(X \geq 3)$  for the random variable  $X$  described in part a) of this problem.