

Directions: *Work on these sheets.*

**Part 1: Multiple Choice.** *Circle the letter corresponding to the best answer.*

1. The probability of any outcome of a random phenomenon is
  - (a) The precise degree of randomness present in the phenomenon
  - (b) Any number as long as it is between 0 and 1
  - (c) Either 0 or 1, depending on whether or not the phenomenon can actually occur or not
  - (d) The proportion of a very long series of repetitions on which the outcome occurs
  - (e) None of the above
  
2. A randomly selected student is asked to respond to yes, no, or maybe to the question, "Do you intend to vote in the next presidential election?" The sample space is { yes, no, maybe }. Which of the following represent a legitimate assignment of probabilities for this sample space?
  - (a) 0.4, 0.4, 0.2
  - (b) 0.4, 0.6, 0.4
  - (c) 0.3, 0.3, 0.3
  - (d) 0.5, 0.3, -0.2
  - (e) None of the above
  
3. If you choose a card at random from a well-shuffled deck of 52 cards, what is the probability that the card chosen is not a heart?
  - (a) 0.25
  - (b) 0.50
  - (c) 0.75
  - (d) 1
  - (e) None of the above
  
4. You play tennis regularly with a friend, and from past experience, you believe that the outcome of each match is independent. For any given match you have a probability of .6 of winning. The probability that you win the next two matches is
  - (a) 0.16
  - (b) 0.36
  - (c) 0.4
  - (d) 0.6
  - (e) 1.2
  
5. If  $P(A) = 0.24$  and  $P(B) = 0.52$  and A and B are independent, what is  $P(A \text{ or } B)$ ?
  - (a) 0.1248
  - (b) 0.28
  - (c) 0.6352
  - (d) 0.76
  - (e) The answer cannot be determined from the information given

**Part 2: Free Response**

*Answer completely, but be concise. Write sequentially and show all steps.*

6. What is meant by disjoint (mutually exclusive) events? Give an example of two disjoint events.
  
  
  
  
  
  
  
  
  
  
7. Define and give an example of two complementary events.

When two dice are rolled, find the probability of getting

8. A sum greater than 9
  
  
  
  
  
  
  
  
  
  
9. A sum less than 4 or greater than 9

A coin is tossed five times.

10. Find the probability of getting at least one tail.
  
  
  
  
  
  
  
  
  
  
11. Find the probability of getting 4 tails.

Suppose you are given a standard 6-sided die and told that the die is “loaded” in such a way that while the numbers 1, 3, 4, and 6 are equally likely to turn up, the numbers 2 and 5 are three times as likely to turn up as any of the other numbers.

12. The die is rolled once and the number turning up is observed. Use the information given above to fill in the following table:

<u>Outcome</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Probability						

13. Let A be the event: the number rolled is a prime number (a number is prime if its only factors are 1 and the number itself; note that 1 is not prime). List the outcomes in A and find  $P(A)$ .

14. Let B be the event: the number rolled is an even number. List the outcomes in B, and find  $P(B)$ .

15. Are events A and B disjoint? Explain briefly.

16. Determine if events A and B are independent.

Consolidated Builders has bid on two large construction contracts. The company president believes that the probability of winning the first contract (event A) is 0.6, that the probability of winning a second (event B) is 0.4, and that the probability of winning both jobs is 0.2.

17. What is the probability of the event  $\{A \text{ or } B\}$  that Consolidated will win at least one of the jobs?

18. Draw a Venn diagram that shows the relation between the events A and B in Exercise 17.

Write each of the following events in terms of A, B,  $A^c$ , and  $B^c$ . Indicate the events on your diagram for 18, and use the information in (17) to calculate the probability of each.

19. Consolidated wins both jobs.

20. Consolidated wins the first job but not the second.

21. Consolidated does not win the first job but does win the second.

22. Consolidated does not win either job.

# Chapter 6

(1) d (2) a (3) c (4) b (5) c (6) Two events A and B are *disjoint* if they have no outcomes in common:  $A \cap B = \emptyset$ . One example of disjoint events: Let  $S =$  whole numbers. Let  $A =$  even whole numbers.  $B =$  odd whole numbers. (Answers will vary.) (7) Two events are *complementary* if they are disjoint and their union is the sample space,  $S$ :  $A \cup B = S$ . One example: Let  $S =$  whole numbers. Let  $A =$  even whole numbers. Then  $A^c =$  odd whole numbers. (Answers will vary.) (8) Outcomes: 6,4 5,5 4,6 6,5 5,6 6,6 so  $p = 6/36 = 1/6$  (9) To the outcomes in 8, annex the outcomes: 1,1 1,2 2,1 so  $p = 9/36 = 1/4$  (10) By the multiplication principle, there are  $2^5 = 32$  outcomes in the sample space.  $P(\text{at least 1 tail}) = 1 - P(\text{no tails}) = 1 - P(\text{HHHHH}) = 1 - 1/32 = 31/32 = .96875$ . (11) If 4 coins come up tails, then one coin is heads, and there are 5 possible positions for this single head. So  $p = 5/32 = .15625$ . (12) The probabilities are as shown:

Outcome	1	2	3	4	5	6
Probability	.1	.3	.1	.1	.3	.1

(13)  $A = \{ 2, 3, 5 \}$  and  $P(A) = P(2) + P(3) + P(5) = .3 + .1 + .3 = .7$  (14)  $B = \{ 2, 4, 6 \}$  and  $P(B) = P(2) + P(4) + P(6) = .3 + .1 + .1 = .5$  (15) A and B are not disjoint since each event contains the outcome 2. (16)  $P(A \text{ and } B) = P(2) = .3$ .  $P(A)P(B) = (.7)(.5) = .35$ . Since  $P(A \text{ and } B) \neq P(A)P(B)$ , A and B are *not* independent. (17)  $.6 + .4 - .2 = .8$ .

(18) See Venn diagram. (19)  $P(A \text{ and } B) = .2$  (20)  $P(A \cap B^c) = P(A) - P(A \cap B) = .6 - .2 = .4$ .

(21)  $P(A^c \cap B) = P(B) - P(A \cap B) = .4 - .2 = .2$  (22)  $P((A \cup B)^c) = 1 - P(A \cup B) = 1 - .8 = .2$

