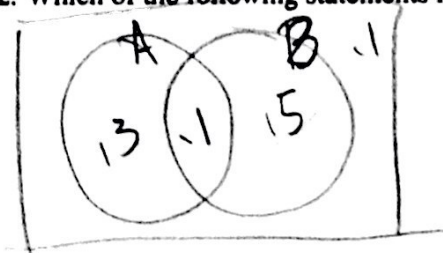


**MULTIPLE CHOICE QUESTIONS. ONLY ONE ANSWER IS CORRECT. CHOICE MUST BE MARKED ON THE SCANTRON, AND ALSO HERE ON THE EXAM. ONLY THE SCANTRON WILL BE GRADED. NO MARKS ON SCANTRON OR MORE THAN ONE MARK WILL RESULT IN 0 POINTS FOR THE QUESTION NOT MARKED, EVEN IF IT IS MARKED ON THE EXAM.** You may use the space near the question for scratch work, but scratch work will not be read.

**Question 1.** A manufacturing company has two retail outlets. It is known that 30% of all potential customers buy products from outlet 1 alone, 50% buy from outlet 2 alone, 10% buy from both 1 and 2, and 10% buy from neither. Let A denote the event that a potential customer, randomly chosen, buys from outlet 1, and let B denote the event that the customer buys from outlet 2. Which of the following statements is true?

- (a)  $P(A) = 0.3$
- (b)  $P(A \cap B) = 0$
- (c)  $P(A \cup B) = 0.7$
- (d)  $P(A^c \cup B^c) = 0.9$
- (e)  $P(A \cup B)^c = 0.9$



**Question 2.** Seven applicants have applied for two jobs. How many ways can the jobs be filled if there are no differences between the jobs?

- (a) 21
- (b) 42
- (c) 49
- (d) 7
- (e) 2

76



**Question 3.** Police report that 78% of drivers stopped on suspicion of drunk driving are given a breath test, 36% a blood test, and 30% both tests. What is the probability that a randomly selected DWI (Driving While Intoxicated) suspect is given none of the tests?

- (a) 0.7
- (b) 0.16
- (c) 0.08
- (d) 0.54
- (e) 0.84



1-.84

**Question 4.** An insurance company believes that people can be divided into two classes: those who are accident prone (A) and those who are not (B). Their statistics show that if a person is accident-prone, he will have an accident (C) at some time within a fixed 1-year period with probability 0.4, whereas if a person is non-accident prone this probability decreases to 0.2. We know that 30 percent of the population is accident prone. The joint probability that a randomly chosen customer is not accident prone and has an accident within 1 year is:

- (a) 0.14
- (b) 0.00196
- (c) 0.08
- (d) 0.12
- (e) 0.86

**Question 5.** A manufacturing company has three out-of-town plants, A, B, and C. The plants are located in different cities. From among ten employees, three are to be selected to go to plant A. In how many ways can this selection be made?

- b
- (a) 1000
  - (b) 120
  - (c) 720
  - (d) 280
  - (e) 880

$$\binom{10}{3} = \frac{10!}{3!7!} = \frac{10 \cdot 9 \cdot 8}{3 \cdot 2} = 120$$

**Question 6.** A customer visiting the suit department of a certain store will purchase a suit with probability 0.22, a shirt with probability 0.3, and a tie with probability 0.28. The customer will purchase both a suit and a shirt with probability 0.11, both a suit and a tie with probability 0.14 and both a shirt and a tie with probability 0.10. A customer will purchase all three items with probability 0.06. Let A be the event that the customer purchases a suit, B the event that the customer purchases a shirt and C the event that the customer purchases a tie. What is the probability that a customer purchases exactly one of these items?

- (a) 0.51
- (b) 0.8
- (c) 0.74
- (d) 0.49
- (e) 0.28



**Question 7.** Ninety percent of all babies survive delivery. However, 15 percent of all births involve Cesarean (C) sections, and when a C section is performed the baby survives 92 percent of the time. If a randomly chosen pregnant woman does not have a C section, what is the probability that her baby survives?

- (a) 0.92
- (b) 0.9835
- (c) 0.8964

$$P(S) = .9$$

$$P(C) = .15$$

$$P(S|C) = .92$$

$$P(S|C^c) = \frac{P(SC^c)}{P(C^c)} = \frac{.9 - P(SC)}{.85}$$

$$\frac{.9 - .15 \cdot .92}{.85} = \frac{.9 - .138}{.85} = \frac{.762}{.85} = .8964$$

April 23, 2014

- (d) 0.345  
(e) 1

**Question 8.** Of the persons arriving at a small airport, 60% fly on major airlines, 30% fly on privately owned airplanes, and 10% fly on commercially owned airplanes not belonging to an airline. Of the persons arriving on major airlines, 50% are traveling for business reasons; the corresponding figures are 60% for persons arriving on private planes and 90% for persons arriving on other commercially owned planes. For a person selected at random from a group of arrivals in commercial airliners, find the probability that the person is traveling on business.

- (a) 0.3158  
(b) 0.9  
(c) 0.18  
(d) 0.57  
(e) 0.43

$$.6 \times .5 + .3 \times .6 + .1 \times .9$$

**Question 9.** Suppose a sample space  $S$  consists of 4 outcomes:  $S = \{a_1, a_2, a_3, a_4\}$ . Which functions define a probability function?

- (a)  $P(a_1) = \frac{1}{2}, P(a_2) = \frac{1}{3}, P(a_3) = \frac{1}{4}, P(a_4) = \frac{1}{3}$   
 (b)  $P(a_1) = \frac{1}{2}, P(a_2) = \frac{1}{4}, P(a_3) = \frac{-1}{4}, P(a_4) = \frac{1}{2}$   
 (c)  $P(a_1) = \frac{1}{2}, P(a_2) = \frac{1}{4}, P(a_3) = \frac{1}{8}, P(a_4) = \frac{2}{8}$   
 (d)  $P(a_1) = \frac{1}{2}, P(a_2) = \frac{1}{4}, P(a_3) = \frac{1}{8}, P(a_4) = \frac{1}{8}$   
 (e)  $P(a_1) = \frac{1}{2}, P(a_2) = \frac{1}{4}, P(a_3) = \frac{1}{8}, P(a_4) = \frac{1}{2}$

**Question 10.** In 1988 the results of the Physicians' Health Study Research Group study were reported in the New England Journal of Medicine. In this study 22071 male physicians (aged from 40 to 84) were randomly assigned to two groups. One group took an aspirin every second day and the other group took a placebo, a pill with no active ingredient which looked just like an aspirin. The participants did not know whether they were taking aspirin or the placebo. After five years the number of participants in each group who had had a heart attack was recorded. The results are shown in the table found on this page.

Treatment	Heart attack	No heart attack	Total
Aspirin	104	10 933	11 037
Placebo	189	10 845	11 034
Total	293	21 778	22 071

For male physicians aged 40 to 84, the risk of having a heart attack for those taking a placebo every second day is..

$$\text{aspirin} = \frac{104}{11037} \quad 9.42 \cdot 10^{-3}$$

$$\text{placebo} = \frac{189}{11034} \quad 1.713$$

- (a) twice the risk for those taking aspirin

- (b) 0.3 the risk for those taking aspirin
- (c) 0.55 the risk for those taking aspirin.
- (d) 3 times the risk for those taking aspirin
- (e) 1.818 the risk for those taking aspirin

**Question 11.** What is the chance that among a group of four people chosen at random at least two were born in the same month (not necessarily the same year). Mark your answer here and in the scantron.

- (a) 0.5729
- (b) 0.333
- (c) 0.215
- (d) 0.427
- (e) 0.001

$$\frac{12 \cdot 11 \cdot 10 \cdot 9}{12^4}$$

**Question 12.** A system with 6 independent components is such that the system will fail if at least one of the individual components fail. The probability that a component fails is 0.02. Let A be the event that the system fails. How many outcomes of the sample space are in A?

- (a) 0.1141
- (b) 0.885842
- (c) 64
- (d) 46656
- (e) 63

**Question 13.** Suppose that you and a friend are matching balanced coins (i.e., each coin has probability 1/2 of landing head). Each of you tosses a coin. If the upper faces match and both are both head, you win 5.00 dollar; if they do not match, you lose 3.00 dollar (your friend wins 3.00 dollar). If they match and they are both tail, you win 1 dollar. Let X be the random sample representing your winnings. Your expected gains and standard deviation are, respectively,

- (a)  $\mu=0.5; \sigma=0.2$
- (b)  $\mu=0; \sigma=3.00$
- (c)  $\mu=3; \sigma=0.5$
- (d)  $\mu=0; \sigma=3.3166$
- (e)  $\mu=3; \sigma=0.4$

HH	5	X =	5	-3	1
HT	-3		1/4	1/2	1/4
TH	-3				
TT	1				

**Question 14.** A town has 1000 people. These people can be classified by their income level and their education, with the following information:

- 100 have  $\leq 16$  years of schooling and make  $> \$50,000$
- 300 have  $> 16$  years of schooling and make  $> \$50,000$
- 400 have  $\leq 16$  years of schooling and make  $\leq \$50,000$ .

$.1 + .3 + .4$   
8

The joint probability that a randomly chosen person has  $> 16$  years of schooling and makes  $> \$50,000$  is

- (a) 0.1
- (b) 0.87
- (c) 0.5
- (d) 0.3
- (e) 0.62

**Question 15.** A doctor is studying the relationship between blood pressure and heartbeat abnormalities in her patients. She tests a random sample of her patients and notes their blood pressures (high, low, or normal) and their heartbeats (regular or irregular). She finds that:

- 14% have high blood pressure.  $P(H) = .14$
- 22% have low blood pressure.  $P(L) = .22$
- 15% have an irregular heartbeat.  $P(HB^c) = .15$
- Of those with an irregular heartbeat, one-third have high blood pressure.  $P(H | HB^c) = \frac{1}{3}$
- Of those with normal blood pressure, one-eighth have an irregular heartbeat.  $P(HB^c | N) = \frac{1}{8}$

$P(N) = .64$

What portion of the patients selected have irregular heartbeat and normal blood pressure?

- (a) 40%
- (b) 20%
- (c) 2%
- (d) 8%
- (e) 5%

$P(HB^c \cap N)$

**Question 16.** It is known that 40 percent of the romantic dates that an adult has while single are not much fun. Two college students seeking a romantic partner decide to start going out independently on dates with other people chosen at random, to look for the fun date out there. Find the probability that both of them find their first fun date in the 5th date. Mark your answer here and in the scantron.

$((.4)^4 (.6))^2$

- (a) 0.601
- (b) 0.00256
- (c) 0.0002359
- (d) 0.341
- (e) 0.03072

**Question 17.** Let  $X$  denote a random variable that has the following probability mass function.

X	-1	0	+1
P(X)	0.2	0.5	0.3

What is the variance of  $X$ ? (mark your answer here and in the scantron)

- (a) 0.1
- (b) 0.51
- (c) 0.3
- (d) 0.49
- (e) 0.01

$\mu = .1$   
 $-(.1)^2 \cdot .2 + .1^2 \cdot .5 + .9^2 \cdot .3$

**Question 18.** A system with 6 independent components is such that the system fails if at least one of the individual components fail. The probability that a component fails is 0.02. Let  $A$  be the event that the system fails. What is the probability that the system fails? (Mark your answer here and in the scantron.)

- (a) 0.987
- (b) 0.8858
- (c) 1
- (d) 0.543
- (e) 0.1141

$.98$

**Question 19.** A system consists of three independent components in parallel. The system works if at least one of the components works. If each component works with probability 0.75, what is the probability that the system works?

- (a) 1
- (b) 0.03
- (c) 0.025
- (d) 0.98
- (e) 0.25

$(.25)^3$

Question 20. Suppose there are 50 people in a group, 30 of them women and 20 men. Suppose we wish to acquire a random sample of 10 people from the group. Let A be the event that there are 4 women and 6 men in the sample. Find the probability of A.

- (a) 0.1034
- (b) 0.89
- (c) 0.405
- (d) 0.34
- (e) 0.67

$$\frac{\binom{30}{4} \binom{20}{6}}{\binom{50}{10}}$$

$$\frac{30!}{4! 26!} \frac{20!}{6! 14!}$$

$$\frac{50!}{40! 10!} \cdot \frac{10987}{9250}$$

$$\frac{30 \cdot 29 \cdot 28 \cdot 27 \cdot 20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15}{4 \cdot 3 \cdot 2}$$

**NOW THAT YOU ARE DONE, CHECK**

- (a) Have you marked your name and ID in the scantron?
- (b) Have you entered all the answers in the scantron and this exam booklet?
- (c) Have you written your name and id in your cheat sheet?
- (d) Have you written your name and id on the first page of the exam?

If so, then  
Insert cheat sheet and scantron between the pages of the exam.  
Close the exam and wait until we collect it from you. Remain seated until every student has turned in the exam.

1	1	2	3	4	5
1	A	B	C	D	E
2	1	2	3	4	5
2	D	B	C	D	E
3	1	2	3	4	5
3	A	D	C	D	E
4	1	2	3	4	5
4	D	B	C	D	E
5	1	2	3	4	5
5	A	D	C	D	E
6	1	2	3	4	5
6	A	B	C	D	D
7	1	2	3	4	5
7	A	B	D	D	E
8	1	2	3	4	5
8	A	D	C	D	E
9	1	2	3	4	5
9	A	B	C	D	E
10	1	2	3	4	5
10	A	B	C	D	D

11	1	2	3	4	5
11	A	B	C	D	E
12	1	2	3	4	5
12	A	B	C	D	D
13	1	2	3	4	5
13	A	B	C	D	E
14	1	2	3	4	5
14	A	B	C	D	E
15	1	2	3	4	5
15	A	B	C	D	E
16	1	2	3	4	5
16	A	B	D	D	E
17	1	2	3	4	5
17	A	B	C	D	E
18	1	2	3	4	5
18	A	B	C	D	D
19	1	2	3	4	5
19	A	B	C	D	E
20	1	2	3	4	5
20	D	B	C	D	E

21	1	2	3	4	5
21	A	B	C	D	E
22	1	2	3	4	5
22	A	B	C	D	E
23	1	2	3	4	5
23	A	B	C	D	E
24	1	2	3	4	5
24	A	B	C	D	E
25	1	2	3	4	5
25	A	B	C	D	E
26	1	2	3	4	5
26	A	B	C	D	E
27	1	2	3	4	5
27	A	B	C	D	E
28	1	2	3	4	5
28	A	B	C	D	E
29	1	2	3	4	5
29	A	B	C	D	E
30	1	2	3	4	5
30	A	B	C	D	E

31	1	2
31	A	B
32	1	2
32	A	B
33	1	2
33	A	B
34	1	2
34	A	B
35	1	2
35	A	B
36	1	2
36	A	E
37	1	2
37	A	C
38	1	2
38	A	C
39	1	2
39	A	C
40	1	2
40	A	C