Elementary Statistics
Test 2 preparation

1 Consider the experiment of rolling a **fair** 8-sided die. Then the sample space is $S=\{1,2,3,4,5,6,7,8\}$. Let $A=\{1,\ 2,\ 3,4\}$, $B=\{2,3,\ 5,\ 6\}$ and $C=\{6,7,8\}$.

(i) Draw a Venn diagram.

(ii) Find the following:

(a) $A\cup B$
(b) $A\cap B$
(c) $(A\cap B)'$
(d) $(A\cup C)'$
(e) $A\cap B'$
(f) $A'\cap B'$
(g) $A'\cup B'$
(h) $A\cap C'$
(i) $P[A\cap B]$
(j) $P\left[(A\cap B)'\right]$
(k) $P[A\cap B']$

2 Given $P(A)$=0.59, $P(B)$=0.46, and $P(A\cap B)$=0.28, draw a Venn diagram, fill in the probabilities associated with the various regions, and thus determine

(a) $P(A\cup B)$;
(b) $P(A\cap B')$;
(c) $P(A'\cap B')$;
(d) $P(A'\cup B')$.

3 Check whether the given function can serve as the probability distribution of an appropriate random variable. **Explain your answer**.

(a)

X	2	4	6
$f(x)$	0.5	0.3	0.2

(b)

X	2	4	6
$f(x)$	- 0.1	0.6	0.5

4 Let a random variable X have a binomial distribution with n = 10 and p = 0.2. Find the following. Hint: Use the tables.

(a) $P\ (\ X = 2\ )$
(b) $P\ (\ X$ is at least $5\ )$
(c) $P\ (\ X$ is less than $2\ )$
(d) $P\ (\ X$ is more than $4\ )$
(e) $P\ (\ X$ is at most $2\ )$
(f) Mean and variance.

5 Childhood lead poisoning is a public health concern in the United States. In a certain population one in ten children has a high blood level of lead. In a randomly chosen group of 15 children from this population, what is the probability that

(a) none has high blood level of lead?

(b) at most 3 have high blood level of lead?

(c) less than 3 have high blood level of lead?

(d) more than 4 have high blood level of lead?

6 Find the mean, variance and the standard deviation of the following distribution.

X	1	2	3
$f(x)$	0.2	0.6	0.2

7 Consider the continuous uniform distribution $f\left(x\right)=\frac{1}{2},\quad 0\le x\le 2$. Find the following probabilities.

(a) $P\left(0<x<0.7\right)$

(b) $P\left(x\ge 0.4\right)$

8 Let the random variable Z have a standard normal distribution. Find the following probabilities. **Also draw graphs**.

(a) $P(Z < 2.5)$
(b) $P(-2.5 < Z < 2.5)$
(c) $P(1.23 < Z < 2.34)$
(d) $P(Z > 2.34)$

9 If z_α denotes the value of z for which the area under the standard normal curve to its right is equal to α, find

(a) $z_{0.025}$;
(b) $z_{0.005}$;
(c) $z_{0.05}$.

10 Drivers who are members of a union earn an average of \$20.00 per hour. Assume that available data indicate wages are normally distributed with a standard deviation of \$2.25.

(a) What is the probability that wages are between \$15.50 and \$24.50 per hour?

(b) What is the probability that the wages are less than \$15.00 per hour?

(c) Find the wage w_0 such that only 2.5% of the union drivers earn more than w_0.

11 Let a random variable X have a normal distribution with mean 10 and standard deviation 2. Find the following probabilities:

Draw graphs.

(a) P (X is at least 13)
(b) P (X is less than 7)
(c) P (X is more than 14)
(d) P (X is at most 15)

12 Sample space is all the possible outcomes of an experiment. (T, F).

13 Probabilities are real numbers between –1 and 1. (T, F)

14 $P(S) = S$. (T, F)

15 For any two events A and B, $P(A \cup B) = P(A) + P(B)$. (T, F)

16 μ is the symbol for sample mean. (T, F)

17 An easy way to find μ is to use the formula $\mu = np$. (T, F)

18 Normal distribution has a symmetric distribution. (T, F)

19 If A and B are mutually exclusive sets (events), then $A \cup B$ is an empty set (event). (T, F)

20 Normal curves are symmetric about the standard deviation. (T, F)

21 Area under the standard normal curve is one unit. (T, F)

22 Area under the curve of a normal distribution with mean 10 and standard deviation 2 is not equal to one. (T, F)

23 What are the basic rules of probability?

24

	A	A'	Total
B	168	172	
B'	57	43	
Total			

Find $P(B)$, $P(A \cap B)$, and $P(A \mid B)$.

25 Match the following symbols with the definitions.

(a)	Sample mean	A' _____
(b)	Sample variance	s _____
(c)	Population mean	σ^2 _____
(d)	Population variance	s^2 _____
(e)	Median	$\bar{X}$ _____
(f)	Sample standard deviation	σ _____
(g)	Population standard deviation	$A \cap B$ _____
(h)	Intersection of events A and B	μ _____
(i)	Union of events A and B	
(j)	Complement of event A	

26 Given the **mutually exclusive** events Y and Z, for which $P(Y) = 0.4$ and $P(Z) = 0.3$, find

(a) $P(Y')$;

(b) $P(Y' \cap Z)$;

(c) $P(Y' \cap Z')$;

(d) $P(Y \cap Z)$;

(e) $P(Y \cup Z)$.

28 What are the four basic rules of probability?

29 Convert probabilities to odds and odds to probabilities.

(a) $p = \frac{7}{11}$

(b) a to b is 13 to 17.

30 Fill in the blanks of the following tables.

Probability

x	$f(x)$
0	0.0532
1	0.2300
2	0.3738
3	0.2699
4	0.0731

Cumulative Probability

x	$F(x)$
0	
1	
2	
3	
4	

31 Fill in the blanks of the following tables.

Cumulative Probability

x	$F(x)$
0	0.1296
1	0.4752
2	0.8208
3	0.9744
4	1.0000

Probability

x	$f(x)$
0	
1	
2	
3	
4	

33 Random variable X have a Binomial distribution with mean 2.8 and p =0.7. Find the variance and standard deviation.

34 Suppose that 5 cards are dealt, without replacement, from a standard deck of 52 cards. What is the probability that 5 cards will include,

(a) exactly one spades?
(b) no spades?
(c) two spades?
(d) at most two spades?
(e) at least two spades?

35 Among 15 applicants for sales positions in a corporation, 8 have college degrees and 7 do not have college degrees. If 4 are randomly selected for interviews, what is the probability that all have college degrees?