

## **CHAPTER 2. PROBABILITY DISTRIBUTIONS**

### **2.1. Probability**

- Probability experiment, outcome and sample space
- Classical and empirical probability
- Law of large numbers

### **2.2. Random variables**

### **2.3. Probability distributions and cumulative probability distributions**

### **2.4. Types of probability distributions**

- Discrete: Bernoulli, Binomial, Negative Binomial, Poisson, Geometric and Multinomial Distribution
- Continuous

### **2.5. Some distributions used in inferential statistics**

- Normal distribution
- Chi square distribution
- F (Fisher) distribution
- t-Student distribution

## Chapter 2: Assignments

1. In a sample of 50 people, 21 had type O blood, 22 had type A blood, 5 had type B blood, and 2 had type AB blood. Set up a frequency distribution and find the following probabilities.
  - a. A person has type O blood.
  - b. A person has type A or type B blood.
  - c. A person has neither type A nor type O blood.
  - d. A person does not have type AB blood.
2. Find the sample space for the gender of the children if a family has three children. Use B for boy and G for girl.
3. Which of the following is NOT a probability?
  - a.  $25/100$
  - b. 1.25
  - c. 1
  - d. 0
4. If a family has three children, find the probability that all the children are girls.
5. If the probability that a person lives in an industrialized country of the world is  $1/5$ , find the probability that a person does not live in an industrialized country.
6. What is the sum of the probabilities of all the outcomes in the sample space?
7. What are the sample spaces of these experiments?

### Experiment

---

Toss one coin  
Roll a die  
Answer a true/false question  
Toss two coins

8. Represent graphically the probability distribution for the sample space for tossing three coins, being the random variable the "number of heads"..
9. Determine whether each distribution is a probability distribution.

a.

$X$	0	5	10	15	20
$P(X)$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

b.

$X$	0	2	4	6
$P(X)$	-1.0	1.5	0.3	0.2

c.

$X$	1	2	3	4
$P(X)$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{9}{16}$

d.

$X$	2	3	7
$P(X)$	0.5	0.3	0.4

10. The number of emails that I get in a weekday is, on average, 0.2 emails per minute. I want to determine what is the probability that I get no emails in an interval of length 5 minutes, and what is the probability that I get more than 3 emails in an interval of length 10 minutes. Which distribution should I use to model this process?
11. A survey found that one out of five Americans say he or she has visited a doctor in any given month. If 10 people are selected at random, find the probability that exactly 3 will have visited a doctor last month.
12. Suppose that the random variable T has the following probability distribution:
- |            |    |    |    |
|------------|----|----|----|
| t          | 0  | 1  | 2  |
| $P(T = t)$ | .5 | .3 | .2 |
- a. Find  $P(T \leq 0)$   
b. Find  $P(T \geq 0 \text{ and } T < 2)$
13. A standard normal distribution has:  
a. the mean equal to the variance  
b. mean equal 1 and variance equal 1  
c. mean equal 0 and variance equal 1  
d. mean equal 0 and standard deviation equal 0  
e. none of these
14. What percent of cases are likely to be between 85 and 89 in a normal distribution with mean 87 and variance 4?  
a. 30.85%                      d. 69.02%  
b. 30.72%                      e. none of these  
c. 49.87%
15. The mean of the population of ten scores, 78, 91, 91, 94, 74, 23, 63, 22, 78, 89 is 70.3, and the modes are 78 and 91. The skewness of the population is:  
a. negative  
b. zero

- c. positive
- d. not determined
- e. positive or negative depending on the score.

16. Suppose a loaded die has the following model:

Face	1	2	3	4	5	6
Probability	0.3	0.1	0.1	0.1	0.1	0.3

If this die is thrown and the top face shows an odd number,

- a. What is the probability that the die shows a four?
- b. What is the probability that the die shows a 1?

17. A probability function is a rule of correspondence or equation that:

- a) Finds the mean value of the random variable.
- b) Assigns values of  $x$  to the events of a probability experiment.
- c) Assigns probabilities to the various values of  $x$ .
- d) Defines the variability in the experiment.
- e) None of the above is correct.

18. What is the principal distinction between a discrete and continuous random variable?  
Give an example of each.