

# Solutions

1. Explain whether each of the following is a uniform distribution:

- a) recording the sum of two dice
- b) cutting a card from a well-shuffled deck
- c) an MP3 player randomly selecting a song from a playlist
- d) the number of boys in a family of five children
- e) randomly selecting five students to be members of a committee

a) **Not uniform**. Each outcome is not equally likely.

b) **Uniform**. There is only one of each card in a deck.

c) **Uniform**. Assuming each song is only on the list once.

d) **Not uniform**. There are different probabilities for the number of boys in a family of five children.

e) **Uniform**. Each student has an equally likely chance of being selected.

2. Which of these is not a uniform distribution?

- A political parties using robo-callers to telephone all constituents in a riding
- B three people being selected at random from a group of four girls and five boys
- C dealing one card, face down, to each of five players
- D a school randomly selecting a student to attend a conference

**C** - The first player has an equal chance of getting any card. Subsequent players do not, as the cards are not replaced.

3. A random number generator provides a number between 1 and 10. What is the expected outcome?

- A 5
- B 50
- C 55
- D 5.5

$$E(x) = [1+2+3+4+5+6+7+8+9+10]/10$$

$$= 55/10$$

$$= 5.5 \longrightarrow \mathbf{D}$$

4. A jar contains red and green balls. A person reaches in and randomly selects a ball to indicate the number of points earned or lost. There are four red balls, each labelled +3 points. How many green balls, each labelled -2 points, would be required for this to be a fair game?

For the game to be fair  $E(x) = 0$

Red "score" + Green "score" = 0

$$4(3) + n(-2) = 0$$

$$12 - 2n = 0$$

$$12 = 2n$$

$$6 = n \quad \text{For a fair game there should be 6 green balls}$$

5. Given the probability distributions, determine the expected values.

$$E(X) = \frac{1}{n} \sum_{i=1}^n x_i$$

a)

x	P(x)
5	$\frac{1}{5}$
10	$\frac{1}{5}$
15	$\frac{1}{5}$
20	$\frac{1}{5}$
25	$\frac{1}{5}$

One fifth = 0.2

$$\begin{aligned} E(x) &= 0.2(5 + 10 + 15 + 20 + 25) \\ &= 0.2(75) \\ &= 15 \end{aligned}$$

The expected value is 15

b)

x	P(x)
0	12.5%
1	12.5%
2	12.5%
3	12.5%
4	12.5%
5	12.5%
6	12.5%
7	12.5%

One eighth = 0.125

$$\begin{aligned} E(x) &= 0.125(0 + 1 + 2 + 3 + 4 + 5 + 6 + 7) \\ &= 0.125(28) \\ &= 3.5 \end{aligned}$$

The expected value is 3.5

6. A random number between 1 and 12 is generated to decide on the hour during which a special contest will be played on a radio station.

- a) Develop the probability distribution for the contest hour, and calculate the expected outcome.
- b) Does this mean that the time represented by the expectation is the most likely to be selected? Explain.

$$\begin{aligned} \text{a) } E(x) &= \frac{1}{12}(1+2+3+4+5+6+7+8+9+10+11+12) \\ &= (78)/12 \\ &= 6.5 \end{aligned}$$

b) No it doesn't. Each time is equally likely to be selected. The value is the predicted average for all of the outcomes.

7. **Communication** A card is randomly selected from a deck.

- a) What is the probability that it is any specific card?
- b) Is this an example of a uniform distribution? Explain.
- c) The card is not placed back into the deck and a second card is selected. What is the probability it is any specific card?
- d) Are the two card choices an example of a uniform distribution? Explain.

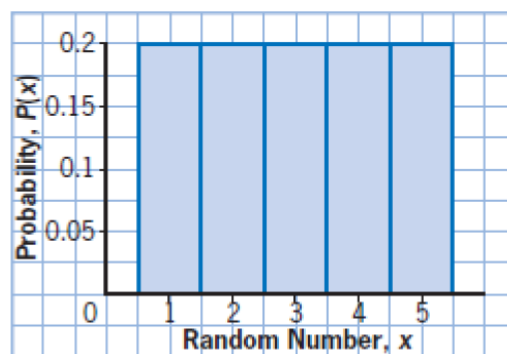
a) Any specific card means any card in a standard deck, so it is  $1/52$ .

b) Yes this is uniform distribution because each card has an equally likely chance of being selected.

c) Any specific card now means any of the remaining cards in the deck, so it is now  $1/51$ .

d) The probabilities have changed, due to the first card not being replaced, so it is not an example of a uniform distribution.

8. A multiple choice test has five possible answers, labelled A, B, C, D, E. If the position of the correct answer is to be chosen at random, draw a probability histogram for this distribution.



Each answer has an equally likely chance of being correct. The probability of each being correct is 0.2 ( $1/5$ ).

Let  $A = 1$ ,  $B = 2$ ,  $C = 3$ ,  $D = 4$ ,  $E = 5$  for the random number  $x$ .