

# Solutions

1. State which type of probability distribution (uniform, binomial, hypergeometric, none of these) would model each situation.

- a) A health inspector is in charge of inspecting 75 restaurants, 15 of which have had health code violations in the past. The inspector randomly selects 10 of the 75 restaurants for inspection. What is the probability that four of these will have had health code violations?
- b) It is estimated that 12% of all restaurants in a city have had health code violations. Ten restaurants are selected at random for inspection. What is the probability that four of these will have had health code violations?
- c) For a charity lottery, you picked 1, 2, 3, 5, and 8 from the numbers 1 to 20. Five different winning numbers are selected at random. What is the probability of three of your numbers matching the five winning numbers?
- d) For a school fundraising draw, 1000 tickets are sold, each with a number from 0001 to 1000. The winning ticket is drawn from a bin. What is the probability of winning the draw?

**Hypergeometric**

Dependent, so not equally likely

**Binomial**

Independent and event is success or failure

**Hypergeometric**

Dependent, so not equally likely

**Uniform**

Independent and equally likely

2. If, in a probability distribution, the number of successes is counted, then the distribution

- A must be binomial
- B must be hypergeometric
- C may be either binomial or hypergeometric
- D may be neither binomial nor hypergeometric

C - Events could be either independent or dependent

3. On a TV game show there are nine squares, five of which have a winning sum of money. The contestant selects four different squares. The probability distribution for the number of squares chosen that contain money is

- A uniform
- B binomial
- C hypergeometric
- D none of the above

C - Dependent events, the probability of choosing a winning square will change after you each selection

4. Identify possible random variables for the following experiments and the values the variables may take:

- |   |   |
|---|---|
| a) dealing five cards from a deck   | d) rolling a die 10 times                               |
| b) naming four members of a committee selected from five grade 11 and seven grade 12 students | e) testing 20 bottles of ginger ale for quality control |
| c) cutting a card from a deck   | f) selecting a winning square on a TV game show         |

a) Number of a type of card Eg 3s or Clubs,  $x = 0, 1, 2, 3, 4, 5$

b) Number of G11s or G12s selected,  $x = 0, 1, 2, 3, 4$

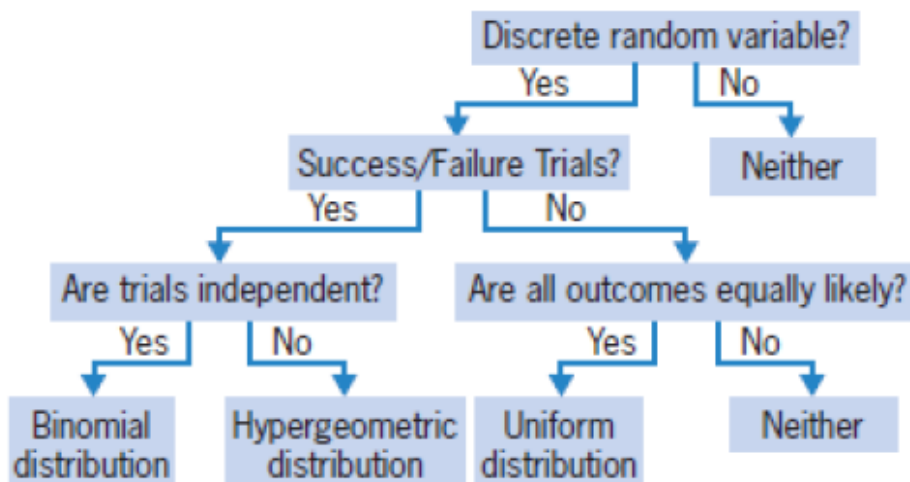
c) The card that is showing Eg 3 or Club,  $x = 1$

d) Number of the digit showing Eg 4s,  $x = 0 \longrightarrow 10$

e) Number of defective bottles,  $x = 0 \longrightarrow 20$

f) The value of the winning square,  $x = 1$

5. **Communication** Make a flowchart to help you decide when to use each type of distribution (uniform, binomial, hypergeometric, neither).



6. A game consists of randomly selecting a number from 1 to 15. Your favourite number is 13, and you are hoping your number will come up.

- a) Is this a uniform or binomial distribution? Explain.
- b) Rewrite the situation to convert it to uniform or binomial, as appropriate.

a) **Uniform** - Each number is equally likely to appear.

b) To make it binomial have the same scenario but with a group of five people choosing. What is the probability of three people choosing the number 1?

7. At Bill's Burger Barn, there is a one in eight chance of winning a free hamburger. Nicolas bought a hamburger every day for five days, hoping to win as many free hamburgers as possible.

- a) Is this a binomial or hypergeometric distribution? Explain.
- b) Rewrite the situation to convert it to binomial or hypergeometric, as appropriate.



a) **Binomial** - Each day is a new independent event.

b) To make it hypergeometric have the option of winning a milkshake as well as a burger. There are 10 burger tickets and 15 milkshake tickets in a hat. If they draw five winning tickets what is the probability of winning a milkshake?

8. For a random draw, 20 slips of paper containing people's names are placed into a bin. Barb noted that four of the names were her friends. Five names will be selected to win a prize, and Barb is hoping at least one of the prizes goes to a friend.
- a) Is this a binomial or hypergeometric distribution? Explain.
- b) Rewrite the situation to convert it to binomial or hypergeometric, as appropriate.
- c) Calculate the probability of success for Barb in each distribution.
- d) Which distribution would make Barb happier? Why?

a) **Hypergeometric** - These are dependent events

b) To make it binomial, have the same scenario but allow the replacement of the names into the bin.

c) **Hypergeometric**

**Binomial**

$$P(\text{at least 1 friend}) = 1 - P(0)$$

$$= 1 - \frac{{}^4C_0 \times {}^{16}C_5}{{}^{20}C_5}$$

$$= 0.7183$$

$$P(\text{at least 1 friend}) = 1 - P(0)$$

$$= 1 - {}_5C_0(0.2)^0(0.8)^5$$

$$= 0.6723$$

d) The **hypergeometric distribution** would make Barb happier as it gives a greater chance of at least one friend being chosen.