# Probability – Unit Review 1

The following problem set reviews sample space diagrams and tree diagrams as well as introducing probability in the context of Venn Diagrams and Two-Way Tables. **** Answers to all problems are provided at the end ****

## Part 1: Sample Space Diagrams and Tree Diagrams

**1** Miloš is taking two summer classes at the local college. One course is 'pass/fail' (those are the only two grades) while the other has a grading system of A, B, C, F (with F being the only failing grade). Assume that the probability of each course is equal.

**a** **Write** the sample space as a list and as a table.

**b** **Use** your diagrams to **find** the probability that:

**i** Miloš passes both classes

**ii** Miloš passes exactly one class

**iii** Miloš fails both classes.

**2** There are four main blood types: A, B, AB and O. These are paired with something called a Rhesus factor, which is either '+' or '–'. For example, your blood type could be B+.

**a** **Write** the sample space for the different blood types that are possible.

If all blood types are equally likely, what is the probability that you have:

**b** type AB– blood

**c** type O blood

**d** a blood type other than A or B

**e** a 'positive' blood type?

**3** At the school picnic, one of the coolers contains 12 cans of juice and 10 cans of soda. Rhona reaches into the cooler to grab a drink for herself and one for her friend Marco.

**Draw** a tree diagram and **calculate** the probability that:

**a** she grabs two juices

**b** she grabs two drinks that are the same

**c** she grabs two drinks that are different

**d** neither person gets a juice.

**4** Olivia rolls two 6-sided dice at the same time. One die has three red sides and three black sides. The other die has the sides numbered from 1 to 6. By means of a tree diagram, table of outcomes or otherwise:

**a** **Find** how many different possible combinations she can roll.

**b** **Calculate** the probability that she will roll a red and an even number.

**c** **Calculate** the probability that she will roll a red or black and a 5.

**d** **Calculate** the probability that she will roll a number less than 2.

**5** Ann has a bag containing 3 blue whistles, 4 red whistles and 1 green whistle.

Simon has a bag containing 2 blue whistles and 3 red whistles.

The whistles are identical except for the color.

Ann chooses a whistle at random from her bag and Simon chooses a whistle at random from his bag.

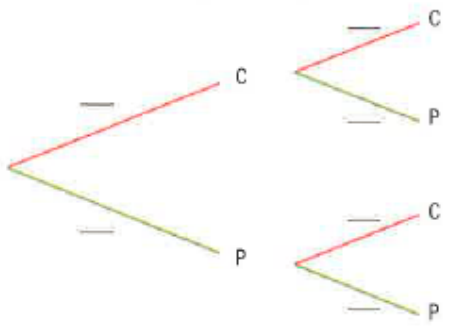
**a** **Draw** a tree diagram to represent this information and **write down** the probability of each of the events on the branches of the tree diagram.

**b** **Calculate** the probability that both Ann and Simon will choose a blue whistle.

**c** **Calculate** the probability that the whistle chosen by Ann will be a different color to the one chosen by Simon.

**7** A bag contains four calculators ($C$) and six protractors ($P$). One item is taken from the bag at random and *not replaced*. A second item is then taken at random.

**a** Complete the tree diagram by writing probabilities in the spaces provided.




**b** **Calculate** the probability that one protractor and one calculator are taken from the bag.

**8** Repeat **Q7**, but this time the item *is* replaced.

**Calculate** how the probabilities change.

## Part 2: Venn Diagrams and Probability

### *Sample Problem:*

In a group of 30 children, 9 children like only vanilla ice cream, 13 like only strawberry ice cream and 5 children like both. The remaining children do not like either flavor.

**a** Draw a Venn diagram to represent this information.

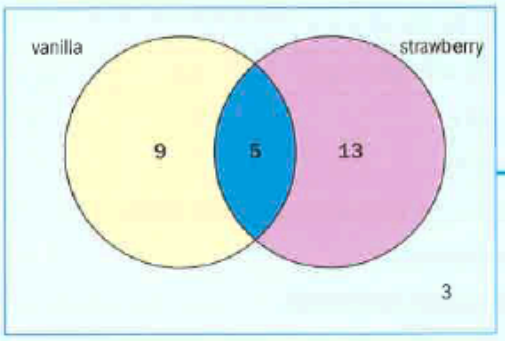
**b** What is the probability that a child picked at random:

**i** likes strawberry ice cream but not vanilla

**ii** doesn't like strawberry or vanilla?

You can use Venn diagrams to represent information and then calculate probabilities from the diagram.

**a**




Draw the Venn diagram. Remember to include the 3 children who like neither flavor.

**b i** P(likes strawberry but not vanilla) $= \frac{13}{30}$

$\frac{n(\text{strawberry but not vanilla})}{n(S)}$

**ii** P(doesn't like strawberry or vanilla) $= \frac{3}{30} = \frac{1}{10}$

### Practice Problems:

**1** In a group of 40 people, 35 choose a main course, 10 choose a starter and 7 choose both.

**a** Draw a Venn diagram to represent this information.

**b** What is the probability that a person picked at random chooses a main course but no starter?

**2** A group of 30 children are asked if they play lacrosse ($L$), basketball ($B$), volleyball ($V$) or none of these sports. The results are:

- 3 children do not play any of these sports
- 2 children play all three sports
- 6 play volleyball and basketball
- 3 play lacrosse and basketball
- 6 play lacrosse and volleyball
- 16 play basketball
- 12 play volleyball

**a** Draw a Venn diagram to display this information.

**b** Calculate the probability that a child selected at random:

**i** plays volleyball and basketball but not lacrosse

**ii** plays only lacrosse

**iii** plays only volleyball.

**6** A recent study of 24 sodas revealed that 8 have high amounts of caffeine, 12 have high amounts of sugar and 6 have both.

**a** **Draw** a Venn diagram to represent this information.

What is the probability that a soda picked at random from the group in the study:

**b** is high in sugar but not in caffeine

**c** is high in caffeine only

**d** is not high in caffeine or sugar?

**10** In a group of 50 people, 10 are healthy and the rest have either high blood pressure, high cholesterol or both; 23 people have high blood pressure and 28 have high cholesterol. **Find** the probability that a person selected at random:

**a** has high blood pressure

**b** has high blood pressure and high cholesterol

**c** has high blood pressure or high cholesterol

**d** has high cholesterol only.

## Part 3: Two-Way Tables and Probability

### *Sample Problem:*

From the two-way table of 150 students and the subjects they study:

| | Science | Arts | Linguistics |
|---|---|---|---|
| Male | 40 | 18 | 33 |
| Female | 15 | 20 | 24 |

**a** Find the probability that a student chosen at random:

**i** is male

**ii** is either male or studies Science.

**b** A female student is picked at random. Find the probability that she studies Arts.

**a i** $P(\text{male}) = \frac{91}{150}$ — 91 male students. Total 150 students.

**ii** $P(\text{male or studies Science}) = \frac{106}{150} = \frac{53}{75}$ — 91 males, plus 15 females studying Science makes 106.

**b** $P(\text{female, studies Arts}) = \frac{20}{59}$ — 59 female students in total, of which 20 study Arts. Note that since it is given that a female student is being picked at random, the sample space is now 59, not 150.

### Practice Problems:

**1** The table shows customers' menu choices in a restaurant.

| | Miso-glazed salmon | Chicken stir-fry | Lamb kibbeh |
|---|---|---|---|
| Male | 9 | 12 | 8 |
| Female | 1 | 14 | 6 |

From this two-way table calculate:

**a** the number of male diners in the restaurant

**b** the number of diners who ordered chicken stir-fry

**c** the probability that a randomly chosen dish was chicken stir-fry for a female diner.

**2 a** Complete a two-way table to represent this information on snowboarding groups. The students were categorized according to gender (M/F) and ability (advanced/intermediate/beginner).

- There were 60 students in total.
- Half of them were male.
- There were 16 male beginners.
- There were 28 beginners in total.
- There were 12 advanced females.
- There were 10 intermediate students in total.

**b** A student is selected at random. Calculate the probability that this student is an advanced male snowboarder.

**9** A typical teenager should consume approximately 2000 calories per day. A survey of 120 students, three-fifths of which were male, revealed the following:

- 80 students ate more than the recommended amount.
- Half of the girls ate less than the recommended amount.
- Five-sixths of the boys ate more than the recommended amount.
- The same number of boys as girls ate the recommended amount of calories.

**a** Complete a two-way table to represent this information.

**Calculate** the probability that a student selected at random:

**b** ate the recommended amount of calories

**c** is male and ate less than the recommended amount

**d** ate more than the recommended amount given that they are female.

## ANSWERS:

## Part 1

**1 a** (P, A) (P, B) (P, C) (P, F) (F, A) (F, B) (F, C) (F, F)

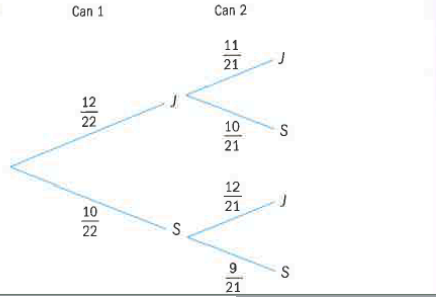
| | A | B | C | F |
|---|---|---|---|---|
| P | P,A | P,B | P,C | P,F |
| F | F,A | F,B | F,C | F,F |

**b i** $\frac{3}{8}$ **ii** $\frac{1}{2}$ **iii** $\frac{1}{8}$

**2 a** A+, A−, B+, B−, AB+, AB−, O+, O−

**b** $\frac{1}{8}$ **c** $\frac{2}{8}=\frac{1}{4}$ **d** $\frac{1}{2}$ **e** $\frac{1}{2}$

**3**

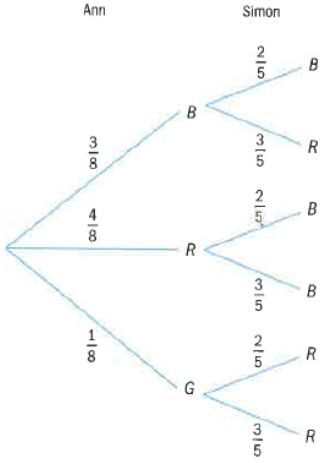



**a** $\frac{2}{7}$ **b** $\frac{37}{77}$

**c** $\frac{40}{77}$ **d** $\frac{15}{77}$

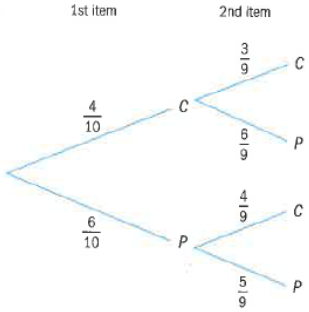
**4 a** 1 2 **b** $\frac{1}{4}$ **c** $\frac{1}{6}$ **d** $\frac{1}{6}$

**5 a**




**b** $\frac{3}{20}$ **c** $\frac{11}{20}$

**7 a**



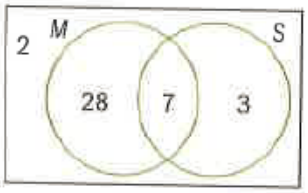

**b** $\frac{8}{15}$

**8 a** As above but second level probabilities are $\frac{4}{10}, \frac{6}{10}, \frac{4}{10}, \frac{6}{10}$

**b** $\frac{12}{25}$ (down by $\frac{4}{75}$)

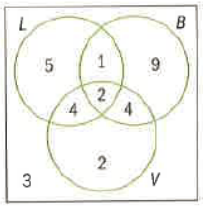
## Part 2

**1 a**



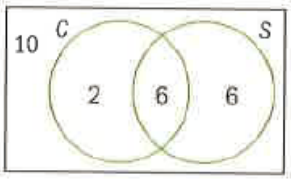

**b** $\frac{28}{40}=\frac{7}{10}$

**2 a**



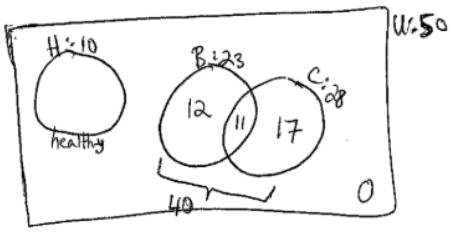

**b i** $\frac{4}{30}=\frac{2}{15}$ **ii** $\frac{5}{30}=\frac{1}{6}$ **iii** $\frac{2}{30}=\frac{1}{15}$

**6 a**




**b** $\frac{6}{24}=\frac{1}{4}$ **c** $\frac{2}{24}=\frac{1}{12}$ **d** $\frac{10}{24}=\frac{5}{12}$

**10 a** $\frac{23}{50}$ **b** $\frac{11}{50}$ **c** $\frac{40}{50}=\frac{4}{5}$ **d** $\frac{17}{50}$




## Part 3

**1 a** 29 **b** 26 **c** $\frac{14}{50}=\frac{7}{25}$

**2 a**

| | A | I | B | Total |
|---|---|---|---|---|
| M | 10 | 4 | 16 | 30 |
| F | 12 | 6 | 12 | 30 |
| Total | 22 | 10 | 28 | 60 |

**b** $\frac{10}{60}=\frac{1}{6}$

**9 a**

| | More | Right | Less | |
|---|---|---|---|---|
| M | 60 | 4 | 8 | 72 |
| F | 20 | 4 | 24 | 48 |
| | 80 | 8 | 32 | 120 |

**b** $\frac{8}{120}=\frac{1}{15}$ **c** $\frac{8}{120}=\frac{1}{15}$ **d** $\frac{20}{48}=\frac{5}{12}$