Sets and Probability

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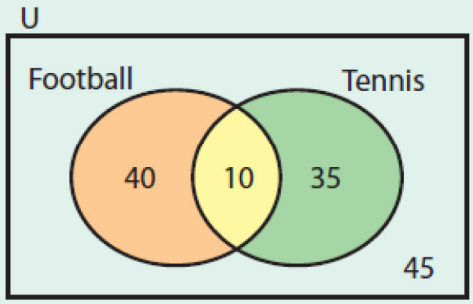
Section 10.6 Probability using Venn diagrams

Example 1

The Venn diagram shows the sports played by members of a club.



How many members played

(i) both football and tennis

(ii) tennis but not football

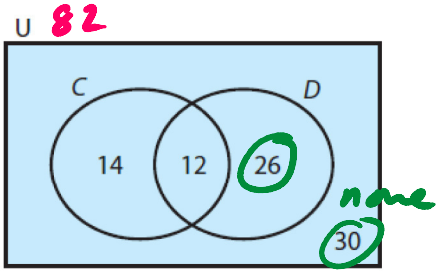
(iii) neither of these two games

(iv) football or tennis?

Now write down the probability of each of the above.

Exercise 10.6

1. In the given Venn diagram,



U represents the houses in a given street,

C represents those which have a cat and

D represents those which have a dog.

$U = 14 + 12 + 26 + 30$

$U = 82$

If a household is selected at random, what is the probability that it has

(i) a cat $\frac{26}{82} = \frac{13}{41}$

(ii) a cat and a dog $\frac{12}{82} = \frac{6}{41}$

(iii) a dog but not a cat $\frac{26}{82} = \frac{13}{41}$

(iv) a cat or a dog $14 + 26 = 40$

$\frac{40}{82} = \frac{20}{41}$

(v) neither a cat nor a dog?

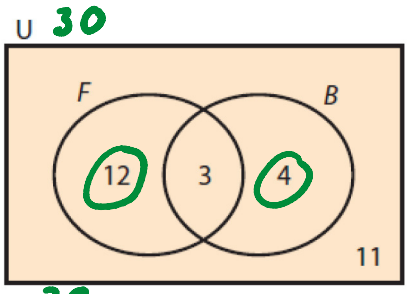
$\frac{30}{82} = \frac{15}{41}$

2. In the given Venn diagram,

U = the students in class 1K

F = the students in the class who play football

B = the students in the class who play badminton.



(i) How many students are there in the class? $12+3+4+11=30$

(ii) How many students play badminton? $3+4=7$

If a student is selected at random from the class, find the probability that the student

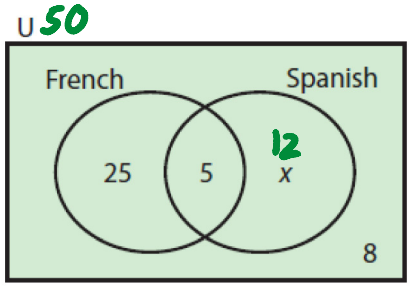
(iii) plays both games $\frac{3}{30}=\frac{1}{10}$

(iv) plays neither game $\frac{11}{30}$

(v) plays badminton but not football $\frac{4}{30}=\frac{2}{15}$

(vi) plays one game only. $12+4=\frac{16}{30}=\frac{8}{15}$

3. The given Venn diagram shows the modern languages, if any, taken by a group of 50 students.



(i) Find the value of x.

$25+5+x+8=50$

$-38 \quad 38+x=50 \quad -38$

$x=12$

If a student is selected at random, find the probability that the student takes

(ii) French $25+5=30/50=\frac{3}{5}$ (added)

(iii) both French and Spanish $5/50=\frac{1}{10}$

(iv) French or Spanish $25+5+12=\frac{42}{50}=\frac{21}{25}$

(v) one of these languages only. $\frac{25+12}{50}=\frac{37}{50}$

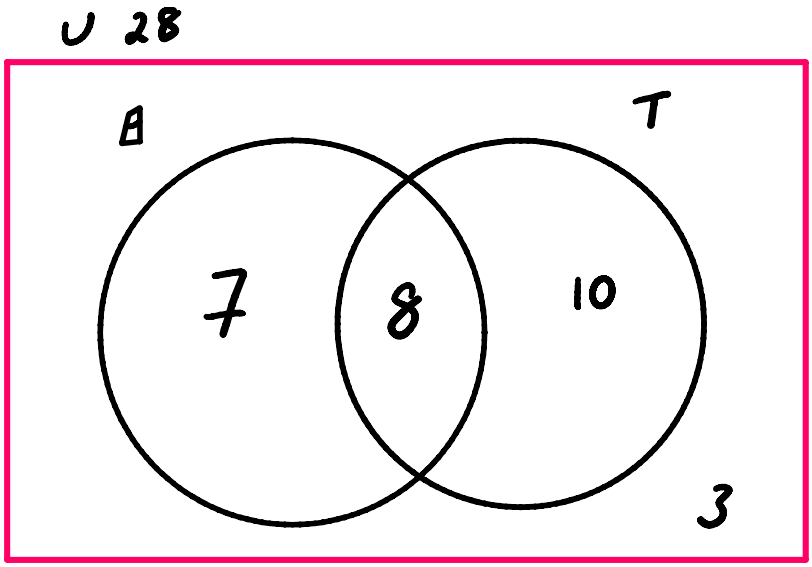
H/W

4. In a class of 28 students, 25 were wearing blazers or ties or both.
Seven wore blazers with no tie and eight wore blazers and ties.

(i) Show this information on a Venn diagram.

(ii) Find the probability that a student selected at random was wearing a tie but not a blazer.

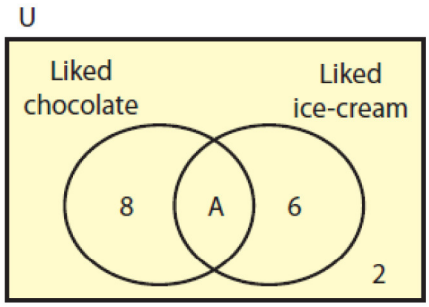
(iii) Find the probability that a student selected at random was wearing neither a tie nor a blazer.



$T = 25 - (7+8)$
$25 - 15$
$= 10$

H/W

5. In a class of 40 children, a survey was carried out to find out how many children liked chocolate and how many liked ice-cream. The Venn diagram shows the results but the region marked A is not filled in.



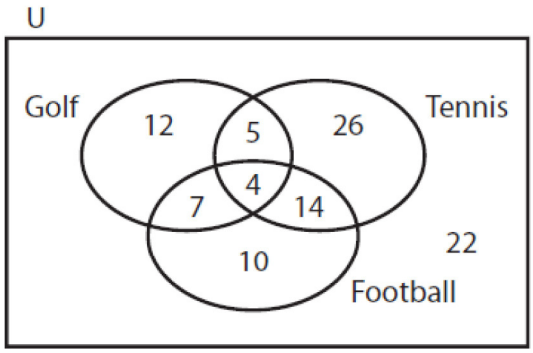
(i) What is the number in region A?

(ii) What can you say about the children in region A?

(iii) If one child is chosen at random, what is the probability that the child liked ice-cream but not chocolate?

(iv) One of the children who liked chocolate is chosen at random. What is the probability that the child also liked ice-cream?

6. The Venn diagram on the right shows the results of a survey of a number of adults to find out which of the games golf, tennis or football, if any, they play.



(i) How many adults were surveyed?

If an adult was selected at random, find the probability that the person plays

(ii) golf

(iii) both golf and tennis

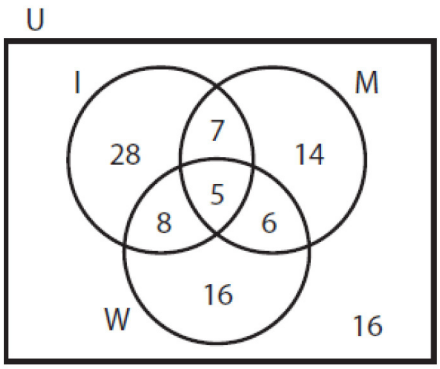
(iv) all three games

(v) football only

(vi) football and tennis

(vii) football and tennis but not golf.

7. The given Venn diagram shows the results of a survey in which 100 people were asked to name which of the papers – *Independent* (I), *Mail* (M) or *World* (W) they had bought the previous Sunday.



If a person was selected at random, find the probability that he/she had bought

(i) the *Independent*

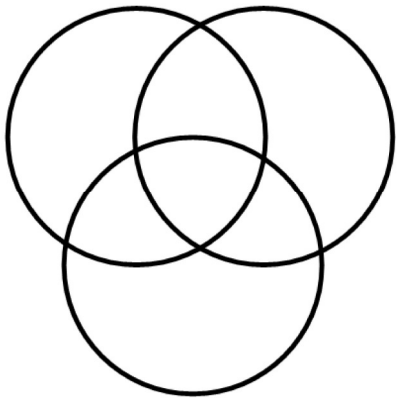
(ii) the *World* and *Mail*

(iii) one paper only

(iv) two papers only

(v) the *Mail* and *Independent* but not the *World*.

8. 35 people coming back from America were asked if they had visited New York, Boston or San Francisco. The results were as follows:



20 had visited New York.
13 had visited Boston.
16 had visited San Francisco.

7 had been to all three cities.

3 had been to both New York and San Francisco, but not Boston.
1 had been to both New York and Boston, but not San Francisco.
8 had been to Boston and San Francisco.

(i) Display this information in a Venn diagram.

(ii) If one person is chosen at random from the group, what is the probability that the person had not visited any of the three cities?

(iii) If one person is chosen at random, what is the probability that the person had visited New York only?

(iv) If one person is chosen at random, what is the probability that the person had visited Boston or New York?

(v) A person who visited New York is chosen at random.
What is the probability that that person also visited Boston?

Answers

Exercise 10.6

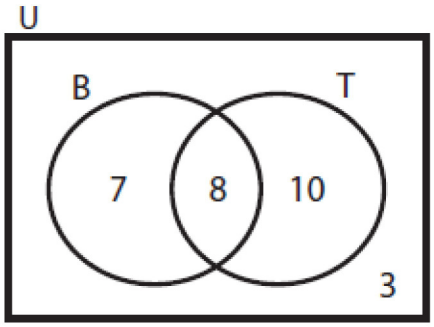
1. (i) $\frac{13}{41}$ (ii) $\frac{6}{41}$ (iii) $\frac{13}{41}$ (iv) $\frac{26}{41}$ (v) $\frac{15}{41}$

2. (i) 30 (ii) 7 (iii) $\frac{1}{10}$

(iv) $\frac{11}{30}$ (v) $\frac{2}{15}$ (vi) $\frac{8}{15}$

3. (i) 12 (ii) $\frac{3}{5}$ (iii) $\frac{1}{10}$ (iv) $\frac{21}{25}$ (v) $\frac{37}{50}$

4. (i)



(ii) $\frac{5}{14}$ (iii) $\frac{3}{28}$

5. (i) 24

(ii) They liked both chocolate and ice-cream

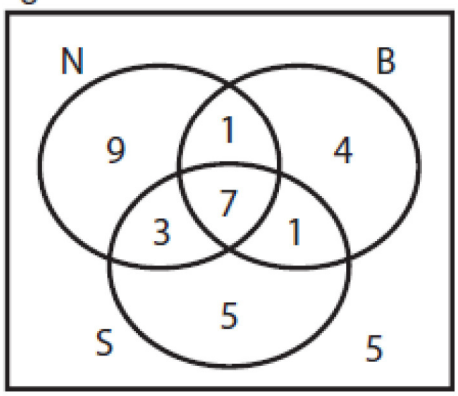
(iii) $\frac{3}{20}$ (iv) $\frac{3}{4}$

Answers

6. (i) 100 (ii) $\frac{7}{25}$ (iii) $\frac{9}{100}$ (iv) $\frac{1}{25}$
(v) $\frac{1}{10}$ (vi) $\frac{9}{50}$ (vii) $\frac{7}{50}$

7. (i) $\frac{12}{25}$ (ii) $\frac{11}{100}$ (iii) $\frac{29}{50}$ (iv) $\frac{21}{100}$ (v) $\frac{7}{100}$

8. (i)



(ii) $\frac{1}{7}$ (iii) $\frac{9}{35}$ (iv) $\frac{5}{7}$ (v) $\frac{2}{5}$