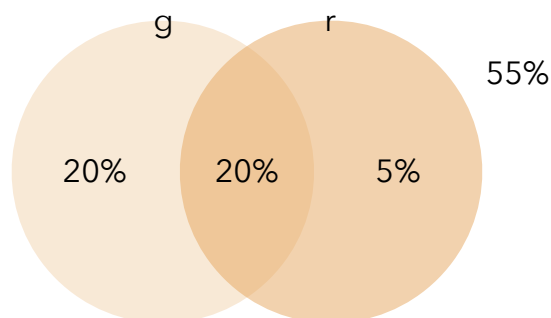# 24. Probability

Analysing survey responses to understand spending habits.

You are undertaking work experience in your town mayor's office. The city council has recently undertaken a survey of the local residents to better understand their spending habits and current financial situation. You have been tasked with assisting with the analysis of this research data.

1. 40% of households spend more than £500 on groceries per month, and 25% of households spend more than £800 on rent per month. If 20% of households spend more than £500 on groceries and more than £800 on rent, what is the probability that a randomly selected household spends more than £500 on groceries or more than £800 on rent?

g = over £500 on groceries
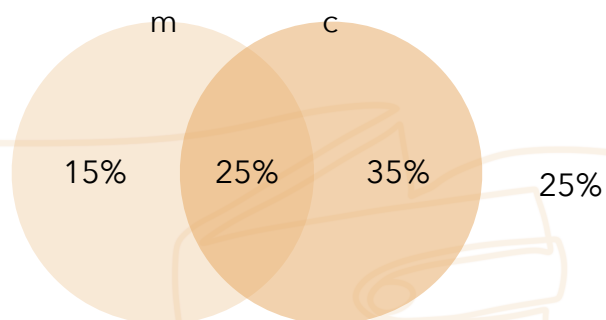
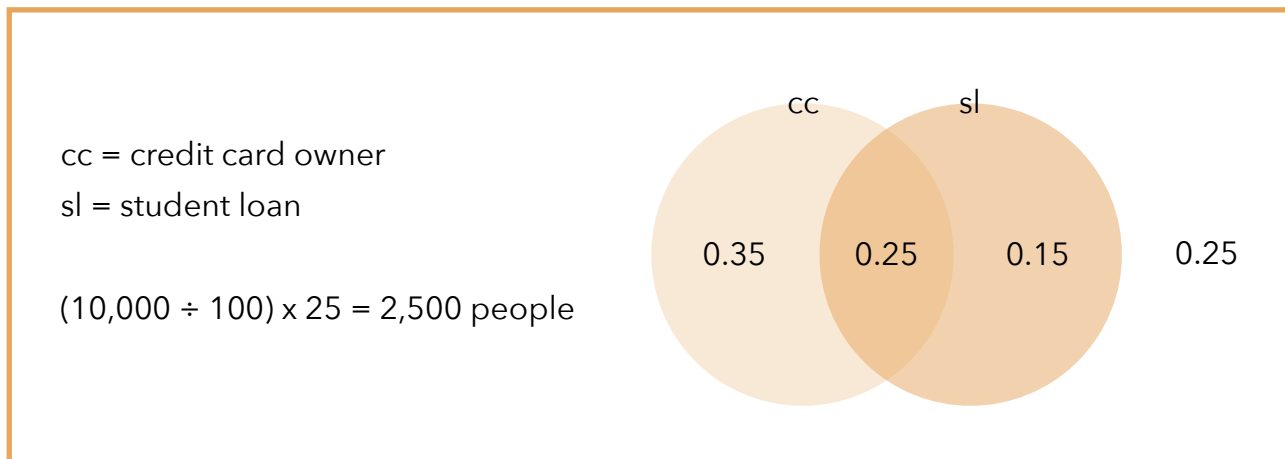r = over £800 on rent

5 + 25 = 25%

g   r

55%

20%   20%   5%

2. In the survey, it is found that 60% of people in the area are car owners, 40% have a mortgage, and 25% both own a car and have a mortgage. If there are 50,000 residents in the town, how many residents neither own a car nor have a mortgage?
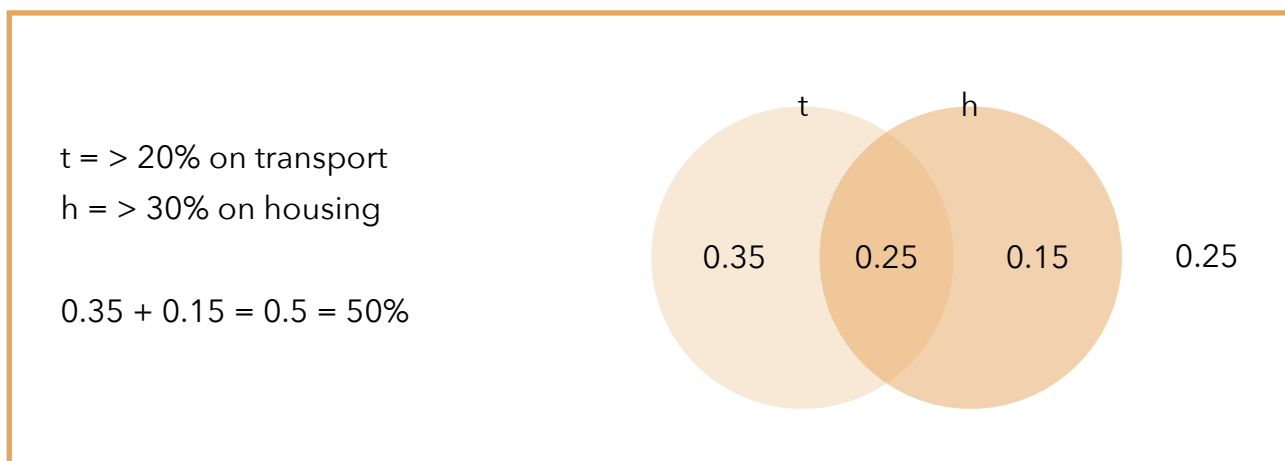
c = car owner

m = have mortgage

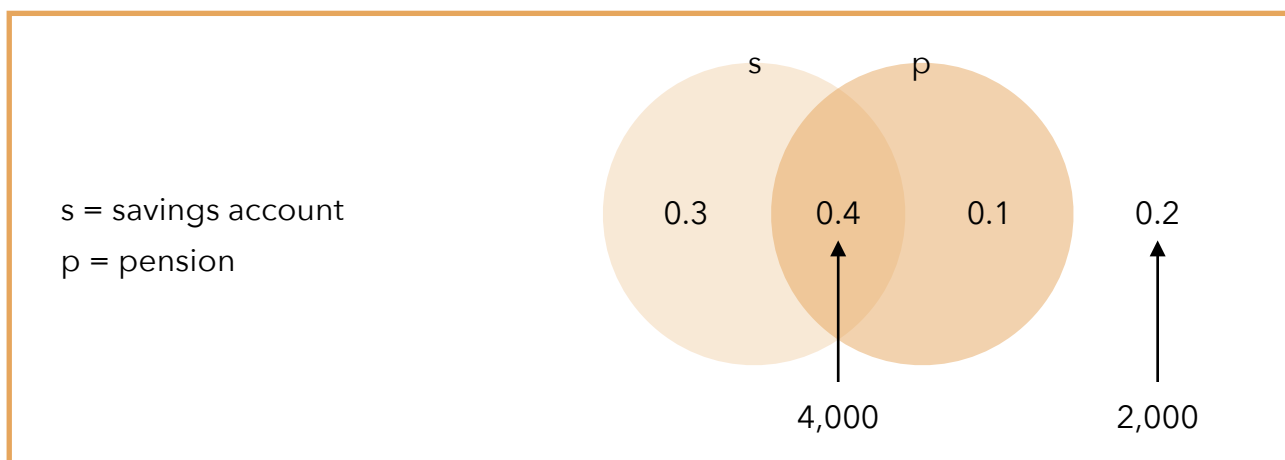50,000 x 25% = 12,500 people

m   c

15%   25%   35%   25%

3. Of the town's residents aged between 18 and 40, the probability that they have a credit card is 0.6, and the probability that they a student loan is 0.4. If it is known that 25% of this group have a credit card and a student loan, and there are 10,000 residents in this age category, how many of them have neither a credit card nor a student loan?

cc = credit card owner

sl = student loan

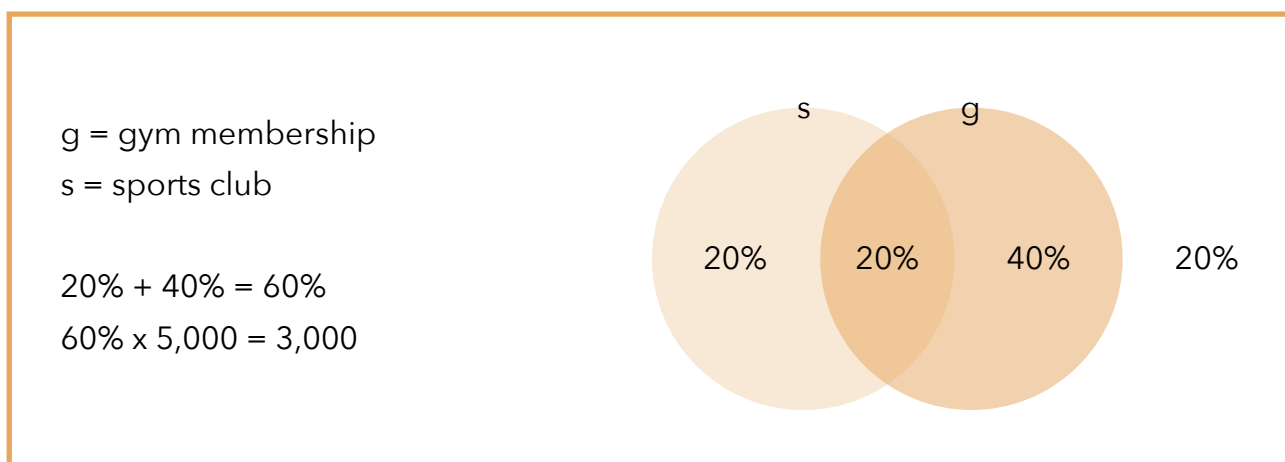(10,000 ÷ 100) x 25 = 2,500 people

cc 0.35   0.25   0.15   sl 0.25

4. The study finds that 40% of people in the town spend more than 30% of their income on housing, while 60% of people spend more than 20% of their income on transportation. If 25% of people spend more than 30% of their income on housing and more than 20% of their income on transportation, what is the probability that a randomly selected person spends more than 30% of their income on housing or more than 20% of their income on transportation?

t = > 20% on transport

h = > 30% on housing

0.35 + 0.15 = 0.5 = 50%

t 0.35   0.25   0.15   h 0.25

5. Among residents aged 18-40, it is found that 70% of have a savings account, 50% have a pension plan, and 40% have both a savings account and a pension plan. Assuming there are 10,000 residents in this age group, present your answer on a Venn diagram and label each section appropriately.

s = savings account

p = pension

s   p

0.3   0.4   0.1   0.2

4,000   2,000

6. It is found that 60% of 25-35 year olds have a gym membership, 40% are members of a sports club, and 20% have both a gym membership and a sports club membership. If there are 5,000 residents aged 25-35, how many residents have either a gym membership or a sports club membership, but not both? Present your answer in a Venn diagram and label each section.

g = gym membership

s = sports club

20% + 40% = 60%

60% x 5,000 = 3,000

s   g

20%   20%   40%   20%

7. Given what you understand about the population of the town and their spending habits, what areas might the mayor consider prioritising future investment in for the town?

- 60% of residents spend over 20% of income on transport. The mayor could consider renovating or building cycle tracks to encourage cycling.
- A large majority are members of some form of health/fitness club. The mayor could upgrade facilities if they are not up to standard. The mayor may also encourage older residents to join.