Questions

Q1.

A manufacturer carried out a survey of the defects in their soft toys. It is found that the probability of a toy having poor stitching is 0.03 and that a toy with poor stitching has a probability of 0.7 of splitting open. A toy without poor stitching has a probability of 0.02 of splitting open.

(a) Draw a tree diagram to represent this information.

(3)

(b) Find the probability that a randomly chosen soft toy has exactly one of the two defects, poor stitching or splitting open.

(3)

The manufacturer also finds that soft toys can become faded with probability 0.05 and that this defect is independent of poor stitching or splitting open. A soft toy is chosen at random.

(c) Find the probability that the soft toy has none of these 3 defects.

(2)

(d) Find the probability that the soft toy has exactly one of these 3 defects.

(4)

(Total 12 marks)

Q2.

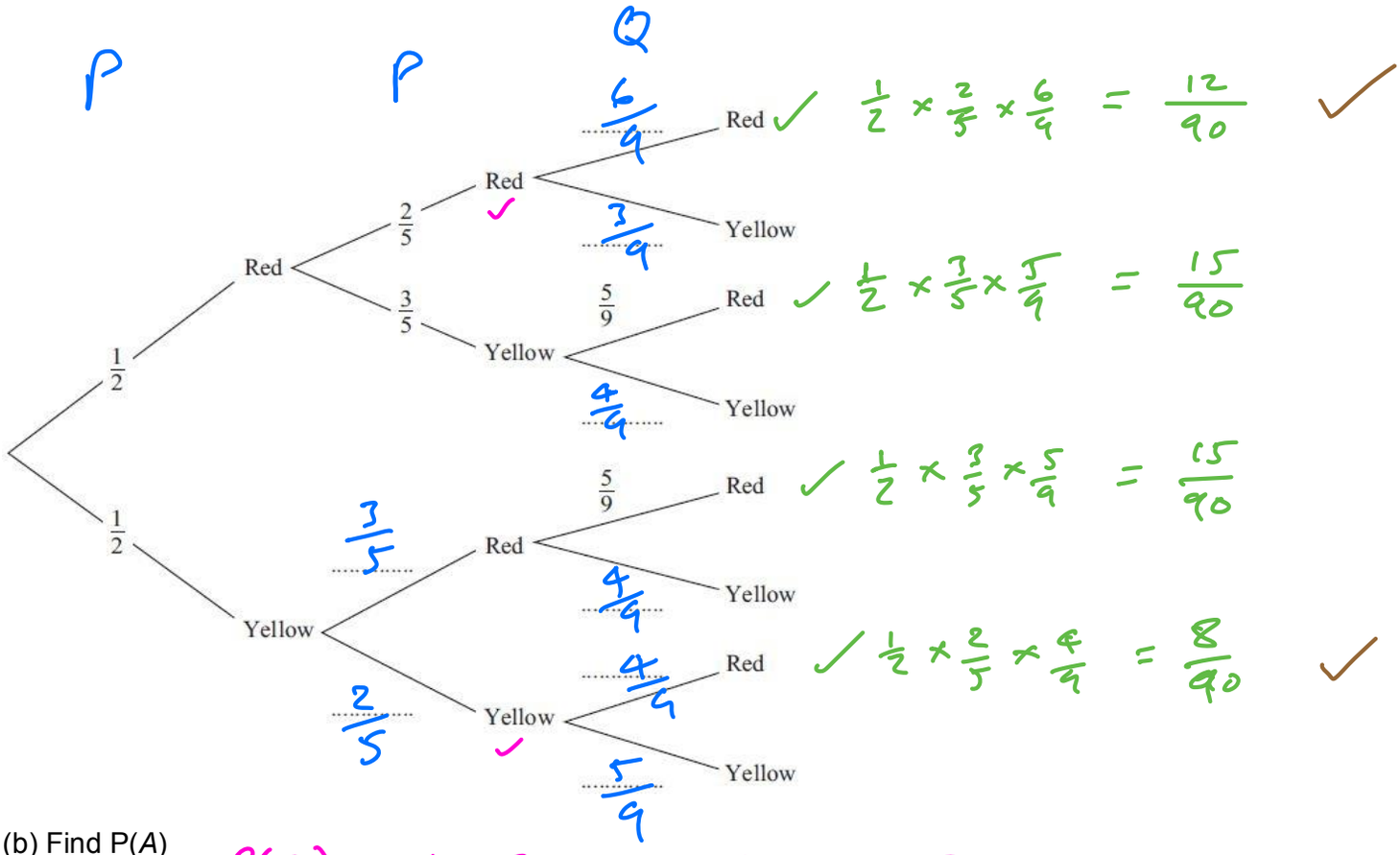
The bag *P* contains 6 balls of which 3 are red and 3 are yellow. The bag *Q* contains 7 balls of which 4 are red and 3 are yellow. A ball is drawn at random from bag *P* and placed in bag *Q*. A second ball is drawn at random from bag *P* and placed in bag *Q*. A third ball is then drawn at random from the 9 balls in bag *Q*.

The event *A* occurs when the 2 balls drawn from bag *P* are of the same colour. The event *B* occurs when the ball drawn from bag *Q* is red.

(a) Complete the tree diagram shown below.

(4)

P 3 Red 3 Yellow Q 4 Red 3 Yellow



(b) Find P(A)

$P(A) = \frac{1}{2} \times \frac{2}{5} + \frac{1}{2} \times \frac{2}{5} = \frac{2}{5}$

(3)

(c) Show that $P(B) = \frac{5}{9}$

$P(B) = \frac{12 + 15 + 15 + 8}{90} = \frac{50}{90} = \frac{5}{9}$

(3)

(d) Show that $P(A \cap B) = \frac{2}{9}$

$P(A \cap B) = \frac{12}{90} + \frac{8}{90} = \frac{20}{90} = \frac{2}{9}$

(2)

(e) Hence find $P(A \cup B)$

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{2}{5} + \frac{5}{9} - \frac{2}{9} = \frac{11}{15}$

(2)

(f) Given that all three balls drawn are the same colour, find the probability that they are all red.

(3)

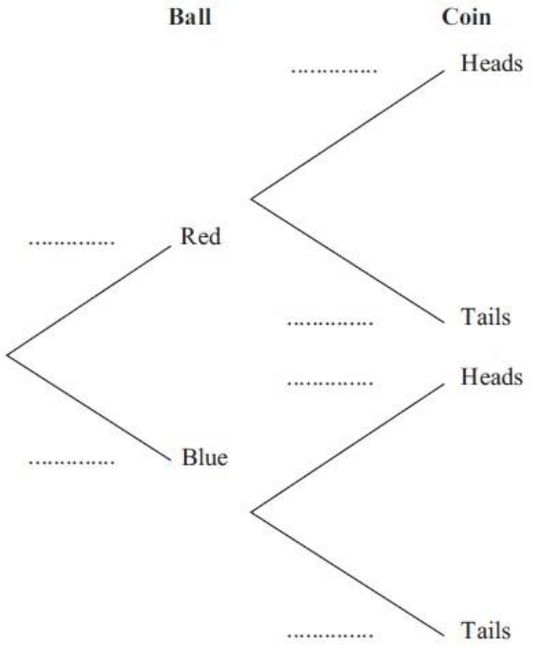
(Total 17 marks)

Q3.

An experiment consists of selecting a ball from a bag and spinning a coin. The bag contains 5 red balls and 7 blue balls. A ball is selected at random from the bag, its colour is noted and then the ball is returned to the bag.

When a red ball is selected, a biased coin with probability $\frac{2}{3}$ of landing heads is spun. When a blue ball is selected a fair coin is spun.

(a) Complete the tree diagram below to show the possible outcomes and associated probabilities.



(2)

Shivani selects a ball and spins the appropriate coin.

(b) Find the probability that she obtains a head.

(2)

Given that Tom selected a ball at random and obtained a head when he spun the appropriate coin,

(c) find the probability that Tom selected a red ball.

(3)

Shivani and Tom each repeat this experiment.

(d) Find the probability that the colour of the ball Shivani selects is the same as the colour of the ball Tom selects.

(3)

(Total 10 marks)

Q4.

A jar contains 2 red, 1 blue and 1 green bead. Two beads are drawn at random from the jar without replacement.

(a) In the space below, draw a tree diagram to illustrate all the possible outcomes and associated probabilities. State your probabilities clearly.

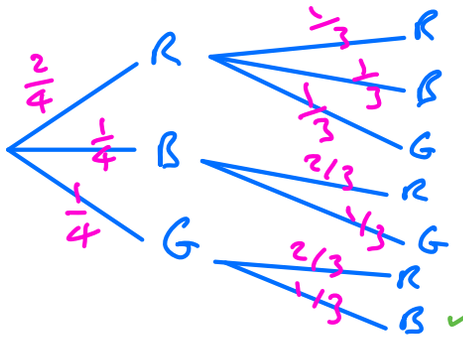
(3)

(b) Find the probability that a blue bead and a green bead are drawn from the jar.

(2)

(Total 5 marks)

Q5.



$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$ ✓

$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$ ✓

Ans $= \frac{2}{12} = \frac{1}{6}$

On a randomly chosen day the probability that Bill travels to school by car, by bicycle or on foot is $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{3}$ respectively. The probability of being late when using these methods of travel is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{1}{10}$ respectively.

(a) Draw a tree diagram to represent this information.

(3)

(b) Find the probability that on a randomly chosen day
(i) Bill travels by foot and is late,
(ii) Bill is not late.

(4)

(c) Given that Bill is late, find the probability that he did not travel on foot.

(4)

(Total 11 marks)

Q6.

In a factory, three machines, *J*, *K* and *L*, are used to make biscuits.

Machine *J* makes 25% of the biscuits.

Machine *K* makes 45% of the biscuits.

The rest of the biscuits are made by machine *L*.

It is known that 2% of the biscuits made by machine *J* are broken, 3% of the biscuits made by machine *K* are broken and 5% of the biscuits made by machine *L* are broken.

(a) Draw a tree diagram to illustrate all the possible outcomes and associated probabilities.

(2)

A biscuit is selected at random.

(b) Calculate the probability that the biscuit is made by machine *J* and is not broken.

(2)

(c) Calculate the probability that the biscuit is broken.

(2)

(d) Given that the biscuit is broken, find the probability that it was not made by machine *K*.

(3)

(Total 9 marks)

Q7.

In a large company,

78% of employees are car owners,
30% of these car owners are also bike owners,
85% of those who are not car owners are bike owners.

(a) Draw a tree diagram to represent this information.

(3)

An employee is selected at random.

(b) Find the probability that the employee is a car owner or a bike owner but not both.

(2)

Another employee is selected at random.

Given that this employee is a bike owner,

(c) find the probability that the employee is a car owner.

(3)

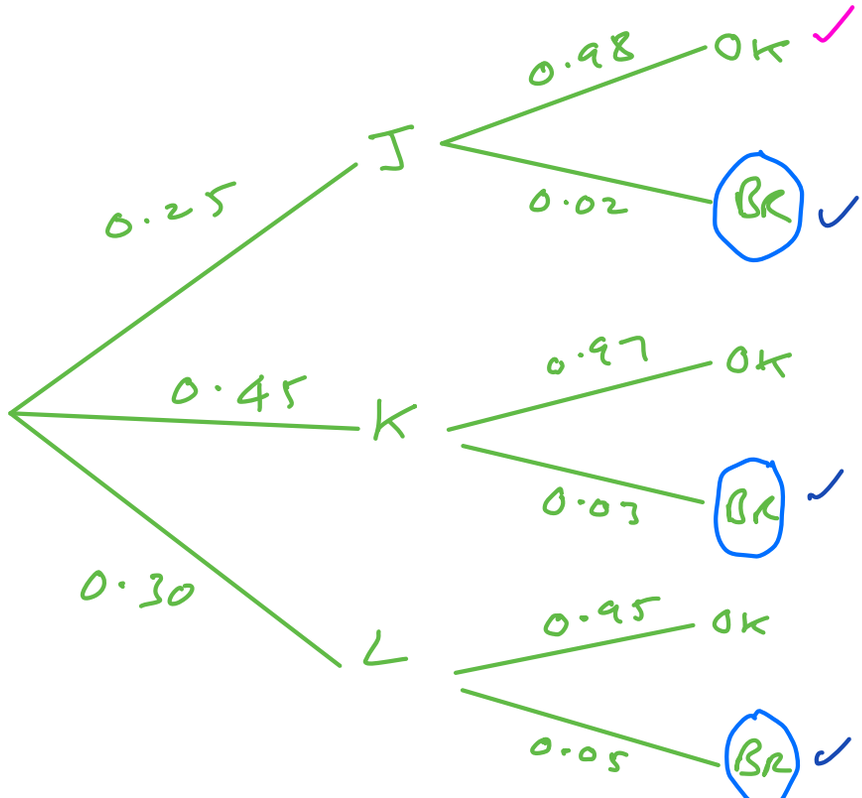
Two employees are selected at random.

(d) Find the probability that only one of them is a bike owner.

(3)

(Total 11 marks)

6)



0.25 × 0.98 = 0.245

b) $0.25 \times 0.98 = 0.245$

c) $P(\text{Broken}) = 0.25 \times 0.02 + 0.45 \times 0.03 + 0.3 \times 0.05$

$= 0.0375$

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d) $P(\text{Not K} \mid \text{Broken}) = \dfrac{P(\text{Not K} \cap \text{Broken})}{P(\text{Broken})}$

$= \dfrac{0.25 \times 0.02 + 0.3 \times 0.05}{0.0375} = \dfrac{40}{67}$
