SHARP

Worksheet 10 Memorandum: Probability

Grade 11 Mathematics

1. a) probability - the likelihood or chance of something happening for example there is a 30% chance it will rain tomorrow (or any other relevant example)

   b) mutually exclusive - when two events cannot happen at the same time for example you cannot be a frog and a cat at the same time (or any other relevant example)

   c) dependent events - an outcome that is affected by another outcome for example getting your driver's licence depends on whether you have a learner's licence (or any other relevant event)

   d) independent events – an outcome that is NOT affected by another outcome for example getting your driver's licence does not depend on whether you ate corn flakes or oats for breakfast.

2. a) P(X) = 0.4 P(Y) = 0.1 P (X or Y) = 0.46 P(X and Y) = 0.04

   P(X and Y) = P(X) x P(Y)
   = 0.4 x 0.1
   = 0.04

   P(X or Y) = P(X) + P(Y) – P(X and Y)
   = 0.1 + 0.4 – 0.04
   = 0.46

   ∴ These events are independent but not mutually exclusive

   b) P(X) = 0.2 P(Y) = 0.7 P (X and Y) = 0.3 P (X or Y) = 0.6

   P(X and Y) = P(X) x P(Y)
   = 0.2 x 0.7
   = 0.14

   P(X or Y) = P(X) + P(Y) – P(X and Y)
   = 0.2 + 0.7 – 0.3
   = 0.6

   ∴ These events are neither mutually exclusive nor independent

   c) P(X) = 0.6 P(Y) = 0.2 P (X or Y) = 0.68 P(X and Y) = 0.12

   P(X and Y) = P(X) x P(Y)
   = 0.6 x 0.2
   = 0.12

   P(X or Y) = P(X) + P(Y) – P(X and Y)
   = 0.6 + 0.2 – 0.12
   = 0.68

   ∴ These events are independent but not mutually exclusive

d) P(X) = 0.3 P(Y) = 0.8 P (X and Y) = 0.5 P (X or Y) = 0.6

P(X and Y) = P(X) x P(Y)

= 0.8 x 0.3

= 0.24

P(X or Y) = P(X) + P(Y) − P(X and Y)

= 0.3 + 0.8 − 0.5

= 0.6

∴ These events are neither mutually exclusive nor independent.

e) P(X) = 0.5 P(Y) = 0.4 P (X or Y) = 0.9 P(X and Y) = 0

P(X and Y) = P(X) x P(Y)

= 0.5 x 0.4

= 0.2

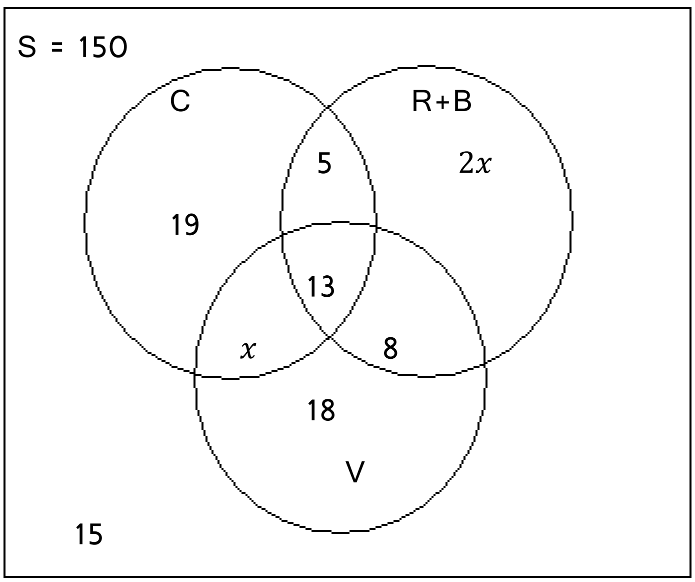
P(X or Y) = P(X) + P(Y) − P(X and Y)

= 0.5 + 0.4 − 0

= 0.9

∴ These events are mutually exclusive and independent.

3. a)



b) $150 = 19 + 5 + 2x + x + 13 + 8 + 18 + 15$

$150 = 78 + 3x$

$3x = 72$

$x = 24$

c) P(liked no muffins) = $\frac{15}{150} = \frac{1}{10} = 0.1$

d) P(Chocolate) = $\frac{19}{150} + \frac{5}{150} + \frac{24}{150} + \frac{13}{150}$

= $\frac{61}{150}$

= 0.41

e) Bran and Vanilla = $2(24) + 8 + 18$

= 74

4. a) Only BSC = 155 – 41

= 114

b) Only BCOM = 500 – (114+41+103 +102)

= 500 – 360

= 140

c) $P(\text{BCOM}) = \frac{41}{500} + \frac{102}{500} + \frac{140}{500}$

$= \frac{283}{500}$

$= 0.566$

d) P(BSC and BA) = 0

They are mutually exclusive events

e) P(BSC or BA) = P(BSC) + P(BA)

$= \left(\frac{114}{500} + \frac{41}{500}\right) + \left(\frac{103}{500} + \frac{102}{500}\right)$

$= \frac{155}{500} + \frac{205}{500}$

$= \frac{360}{500}$

$= \frac{18}{25}$

$= 0.72$

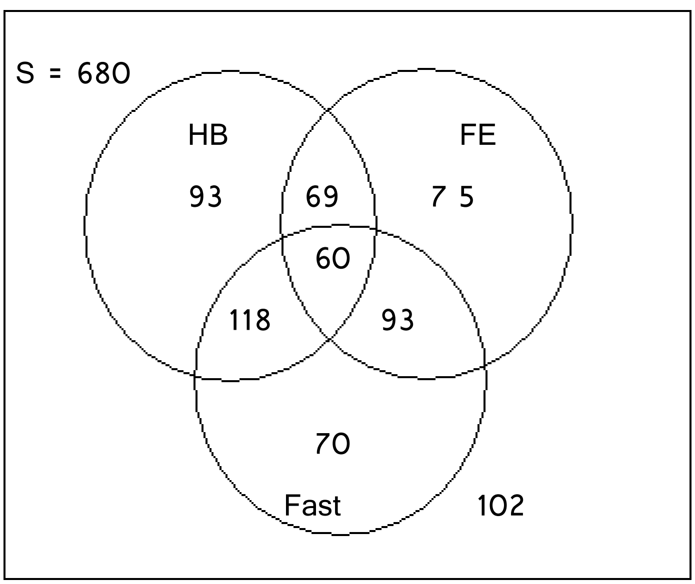
f) P((BSC and BCOM) or (BA and BCOM)) = P(BSC and BCOM) + P(BA and BCOM)

$= \frac{41}{500} + \frac{102}{500}$

$= \frac{143}{500}$

$= 0.286$

5. a)



No characteristic = 680 – 578

= 102

All 3 = 60

HB and Fast = 178- 60 = 118

Fast and FE = 153 – 60 = 93

Fast = 341 – (118 +60 +93) = 70

HB and FE = x

Then HB = 340 – (118+60 +x)

= 162 - x

And FE = 297 – (x +60 +93)

= 144 - x

To find x: 578 = HB +FE + Fast

578 = 162 – x +x +118+60+93+ 144 – x + 70

$x = 69$

b) No characteristic = 680 – 578 = 102

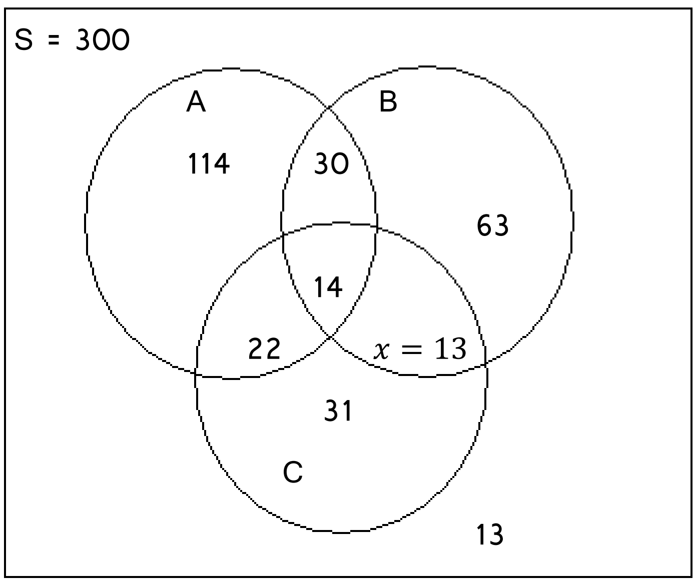
c) P(HB and FE) $= \frac{69}{680} + \frac{60}{680}$

$= \frac{129}{680}$

$= 0.19$

d) The results seem to be spread quite evenly across the three characteristics although the most votes went to a hatchback car that is fast. Fuel efficient seemed to be the least popular characteristic. Thus I would advise the car manufacturer to make a car that is a fast hatchback. (Or any other relevant argument)

6. a)



Other network = 300 – 287

= 13

All 3 = 14

A and B = 44 – 14 = 30

A and C = 36 -14 = 22

A = 180 – (30+14+22) = 114

B and C = x

C = 80 – (22+14 +x) = 44 – x

B = 120 – (30+14+x) = 76 – x

To find x: 287 = 114+ 30 +76 – x +22+14 +x+ 44 – x

287 = 300 – x

$x = 13$

b) No network = 300 – 287 = 13

c) Two or more networks = 30 +14 + 22 + 13 = 79

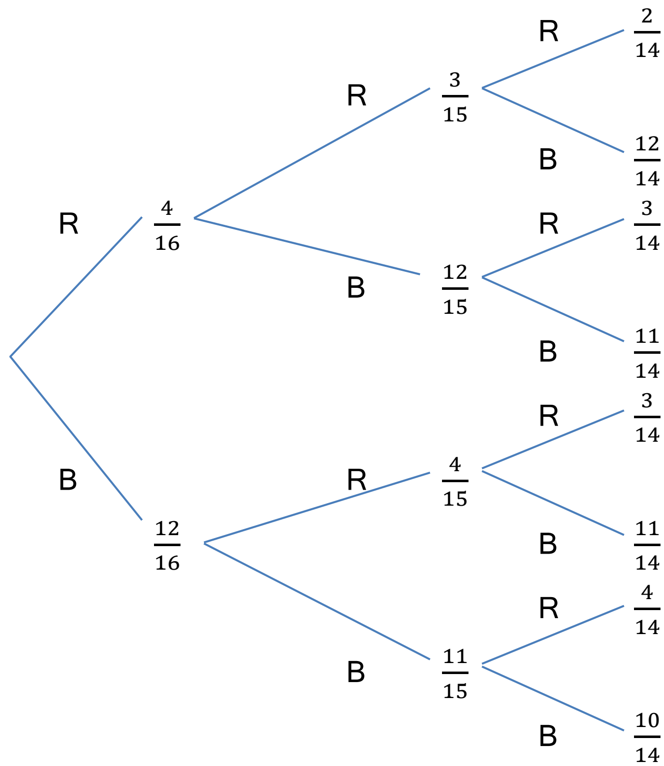
d) P(Only one network) = $\frac{114}{300} + \frac{63}{300} + \frac{31}{300}$

= $\frac{208}{300}$ = $\frac{52}{75}$

= 0.69

7. a) P(red) = $\frac{4}{16} = \frac{1}{4} = 0.25$ P(blue) = $\frac{12}{16} = \frac{3}{4} = 0.75$

b) i)



$= \frac{4}{16} \times \frac{3}{15} \times \frac{2}{14} = \frac{1}{140}$ RRR

$= \frac{4}{16} \times \frac{3}{15} \times \frac{12}{14} = \frac{3}{70}$ RRB

$= \frac{4}{16} \times \frac{12}{15} \times \frac{3}{14} = \frac{3}{70}$ RBR

$= \frac{4}{16} \times \frac{12}{15} \times \frac{11}{14} = \frac{11}{70}$ RBB

$= \frac{12}{16} \times \frac{4}{15} \times \frac{3}{14} = \frac{3}{70}$ BRR

$= \frac{12}{16} \times \frac{4}{15} \times \frac{11}{14} = \frac{11}{70}$ BRB

$= \frac{12}{16} \times \frac{11}{15} \times \frac{4}{14} = \frac{11}{70}$ BBR

$= \frac{12}{16} \times \frac{11}{15} \times \frac{10}{14} = \frac{11}{28}$ BBB

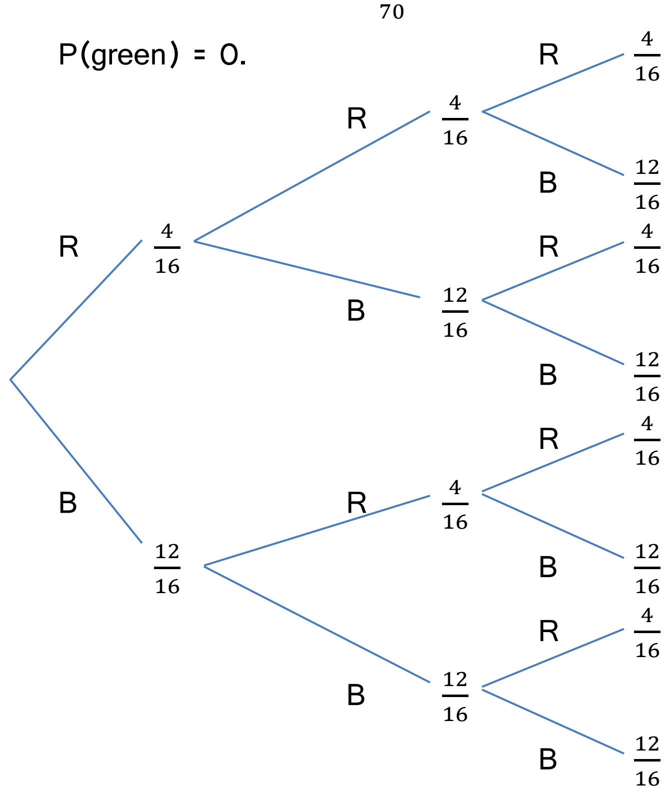
ii) P(RRR) = $\frac{4}{16} \times \frac{3}{15} \times \frac{2}{14} = \frac{1}{140}$

iii) P(one red and two blue) $= \frac{11}{70} + \frac{11}{70} + \frac{11}{70}$

$= \frac{33}{70}$

iv) P(green) = 0.

c) i)



$= \frac{4}{16} \times \frac{4}{16} \times \frac{4}{16} = \frac{1}{64}$ RRR

$= \frac{4}{16} \times \frac{4}{16} \times \frac{12}{16} = \frac{3}{64}$ RRB

$= \frac{4}{16} \times \frac{12}{16} \times \frac{4}{16} = \frac{3}{64}$ RBR

$= \frac{4}{16} \times \frac{12}{16} \times \frac{12}{16} = \frac{9}{64}$ RBB

$= \frac{12}{16} \times \frac{4}{16} \times \frac{4}{16} = \frac{3}{64}$ BRR

$= \frac{12}{16} \times \frac{4}{16} \times \frac{12}{16} = \frac{9}{64}$ BRB

$= \frac{12}{16} \times \frac{12}{16} \times \frac{4}{16} = \frac{9}{64}$ BBR

$= \frac{12}{16} \times \frac{12}{16} \times \frac{12}{16} = \frac{27}{64}$ BBB

ii) P(only blue marbles) $= \frac{12}{16} \times \frac{12}{16} \times \frac{12}{16} = \frac{27}{64}$

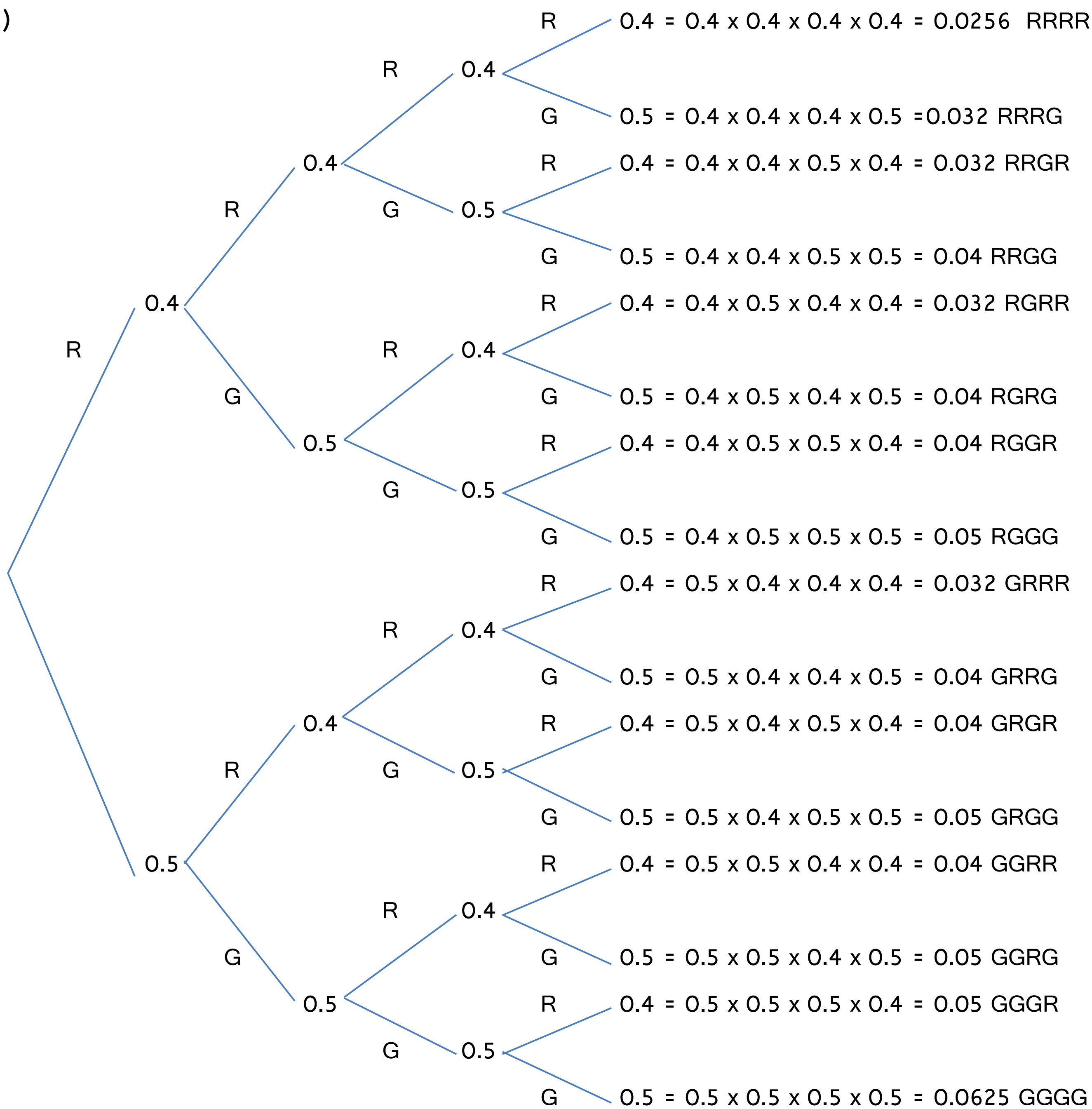
iii) P(two red and one blue) $= \frac{3}{64} + \frac{3}{64} + \frac{3}{64}$

$= \frac{9}{64}$

iv) P(at most one red) $= \frac{9}{64} + \frac{9}{64} + \frac{9}{64} + \frac{27}{64}$ (means one red or no red)

$= \frac{27}{32}$

8. a)



b) P(4 green lights) $= 0.5 \times 0.5 \times 0.5 \times 0.5 = 0.0625$

c) P(two red and two green) $= 0.04 + 0.04 + 0.04 + 0.04 + 0.04 + 0.04 = 0.24$

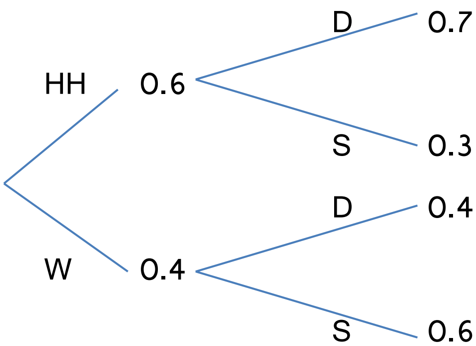
d) P(No green) $= 0.4 \times 0.4 \times 0.4 \times 0.4 = 0.0256$ (Only red lights)

e) If there are three options: Red, Green and Orange then the total probabilities must add up to one, ∴ 1 = P(red) + P(green)+ P(orange)

1 = 0.4 +0.5 + P(orange)

∴ P(orange)= 0.1

9. a)



= 0.6 x 0.7 = 0.42 HH and D

= 0.6 x 0.3 = 0.18 HH and S

= 0.4 x 0.4 = 0.16 W and D

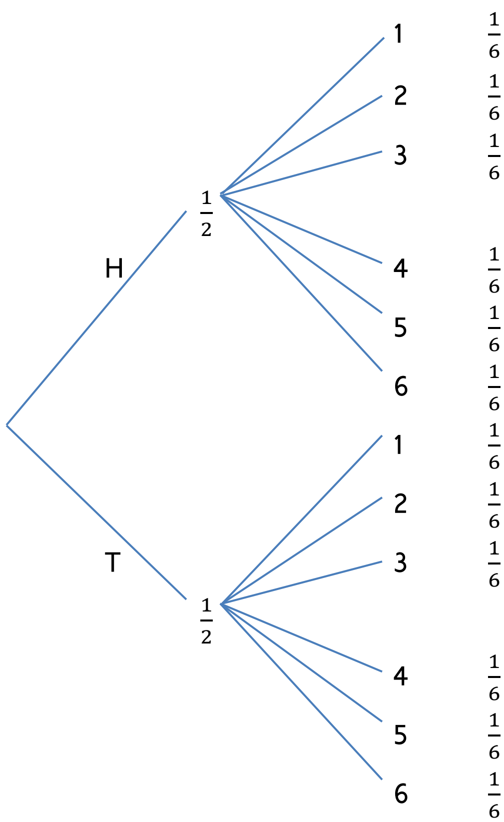
= 0.4 x 0.6 = 0.24 W and S

b) P(High Heels and Skirt) = 0.6 x 0.3 = 0.18

c) P(Wedges and Skirt) = 0.4 x 0.6 = 0.24

d) Thabang is most likely to wear the high heels and dress as this outfit has the highest probability.

10. a)



$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$\rightarrow \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

b) P (6H and 1T) $= \frac{1}{12} + \frac{1}{12} = \frac{1}{6}$

c) P(winning twice) = P(winning) x P(winning)

$= \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

d) P(even and heads) $= \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$

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

e) P(multiple of 3 and tails) $= \frac{1}{12} + \frac{1}{12}$

$= \frac{1}{6}$

f) P(ace and 6) = P(ace) x P(6)

$= \frac{4}{52} \times \frac{1}{6}$

$= \frac{1}{78}$

g) I would play the game of dice and coin as the probability of winning is much higher.