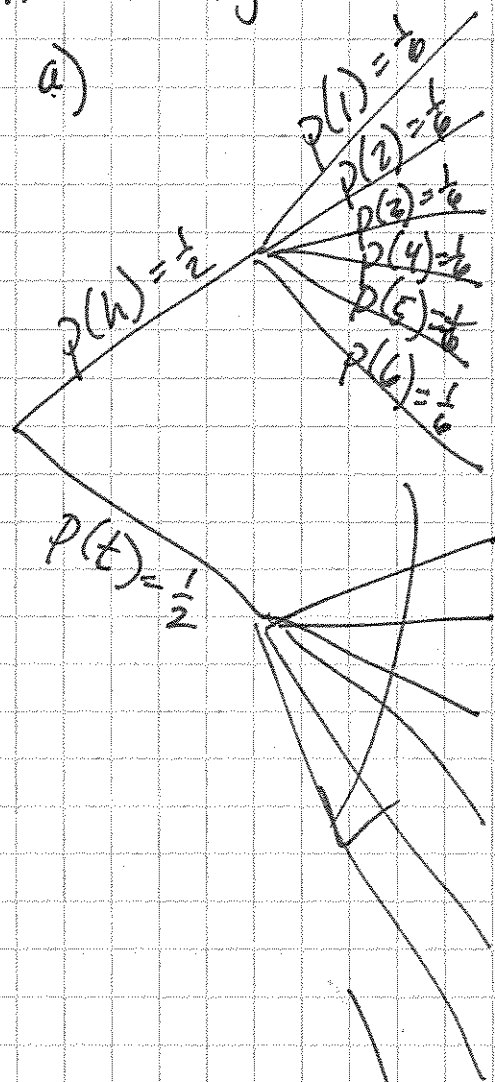
Multi-stage

1. a)



$p(h,1) = \frac{1}{2} \cdot \frac{1}{6} = \frac{1}{12}$

$p(h,2) =$

$p(h,3) =$

$p(h,4) =$

$p(h,5) =$

$p(h,6) =$

$p(t,1) =$

$p(t,2) =$

$p(t,3) =$

$p(t,4) =$

$p(t,5) =$

$p(t,6) =$

b)

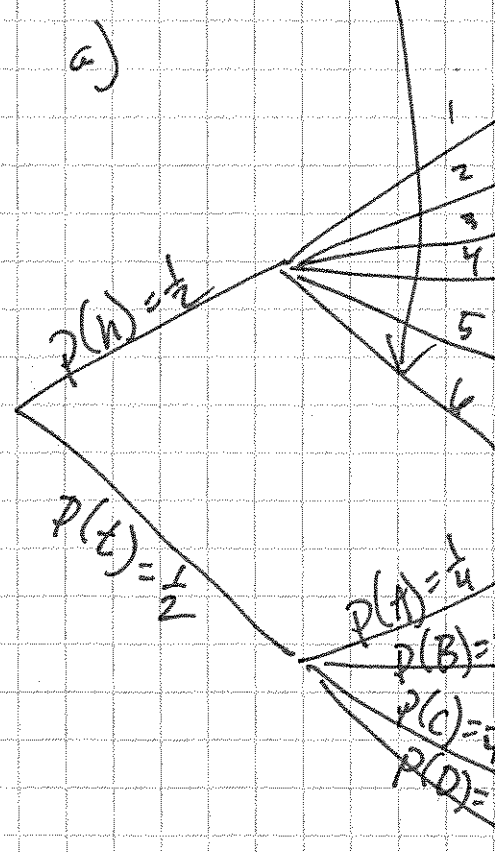
$p(h,3) = \frac{1}{12}$

$p(t,odd) =$

$\frac{1}{12} + \frac{1}{12} + \frac{1}{12} =$

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

2. a)



$p(h,1,h) = \frac{1}{2} \cdot \frac{1}{6} \cdot \frac{1}{2} = \frac{1}{24}$

$p(h,1,t) = \frac{1}{24}$

$p(h,2,h) = \frac{1}{24}$

$p(h,2,t) = \frac{1}{24}$

$p(h,3,h) =$

$p(h,3,t) =$

$p(h,4,h) =$

$p(h,4,t) =$

$p(h,5,h) =$

$p(h,5,t) =$

$p(h,6,h) =$

$p(h,6,t) =$

$p(t,A,h) = \frac{1}{2} \cdot \frac{1}{4} \cdot \frac{1}{2} = \frac{1}{16}$

$p(t,A,t) = \frac{1}{16}$

$p(t,B,h) =$

$p(t,B,t) =$

$p(t,C,h) =$

$p(t,C,t) =$

$p(t,D,h) =$

$p(t,D,t) =$

2. b) $p(\text{spinner}) = 8 \cdot \frac{1}{16} = \frac{8}{16} = \frac{1}{2}$

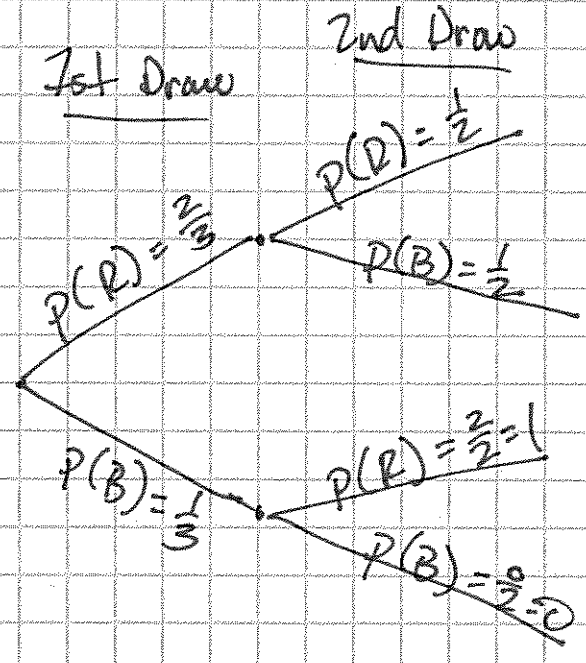
c) $p(\text{Even}, t) = 3 \cdot \frac{1}{24} = \frac{3}{24} = \frac{1}{8}$

3. a) $a = .3$, $b = .2$, $c = .7$

$d = .7 \cdot .8 = .56$
$e = .7 \cdot .2 = .14$
$f = .3 \cdot .7 = .21$
$g = .3 \cdot .3 = .09$
$+$

b) 1.00 Yes, it seems reasonable because there is a 100% that one of these outcomes will happen.

4. Draw 2 marbles 1 blue, 2 red, w/o replacement



$p(R, R) = \frac{2}{3} \cdot \frac{1}{2} = \frac{1}{3}$

$p(R, B) = \frac{1}{3}$

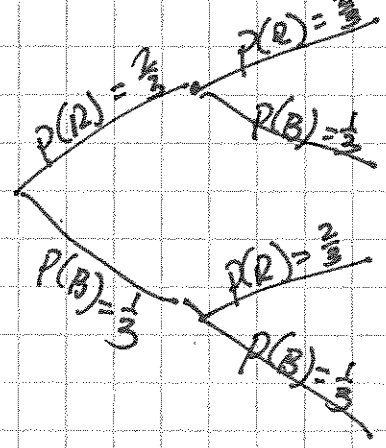
$p(B, R) = \frac{1}{3} \cdot 1 = \frac{1}{3}$

$p(B, B) = \frac{1}{3} \cdot 0 = 0$

$+$

1 ✓

5. Draw 2 marbles 1 blue, 2 red w/ replacement



$P(R,R) = \frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$

$P(R,B) = \frac{2}{3} \cdot \frac{1}{3} = \frac{2}{9}$

$P(B,R) = \frac{1}{3} \cdot \frac{2}{3} = \frac{2}{9}$

$P(B,B) = \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}$

$+$

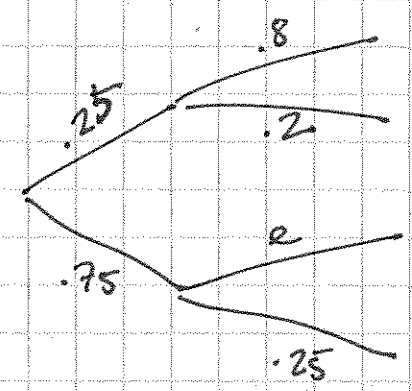
1 ✓

6. a) independent

b) dependent

c) independent

7.



$c = .25 \cdot .8 = .2$

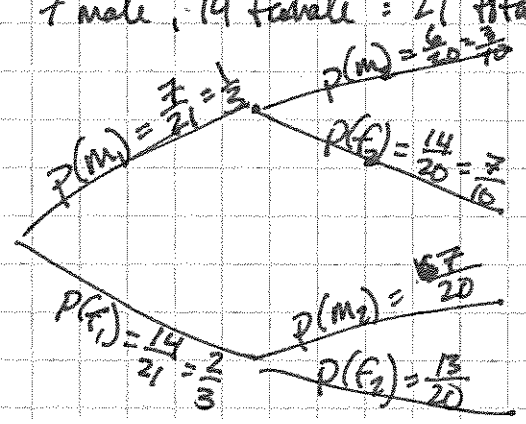
$d = .25 \cdot .2 = .05$

$.5625$

$e = \frac{.5625}{.75} = .75$

$g = .75 \cdot .25 = .1875$

8. 7 male, 14 female = 21 total



$P(m_1, m_2) = \frac{1}{3} \cdot \frac{3}{10} = \frac{3}{30}$

$P(m_1, f_2) = \frac{1}{3} \cdot \frac{7}{10} = \frac{7}{30}$

$P(f_1, m_2) = \frac{2}{3} \cdot \frac{7}{20} = \frac{7}{30}$

$P(f_1, f_2) = \frac{2}{3} \cdot \frac{13}{20} = \frac{13}{30}$

9. Dependent → The first selection changes the probability of the second.

10. a) total rolls: 100

exp prob(6) = $\frac{18}{100}$ = .18

b) theoretical prob(6) = $\frac{1}{6}$ = .17

c) exp prob(even) = $\frac{3}{6}$ = $\frac{1}{2}$ = .5

d) theoretical prob(even) = $\frac{51}{100}$ = .51

e) results are very close! The die seems to be fair!

11. 4 g, 5 y, 1 b = 10 marbles

Exp. A: drew marble, put it back, drew a 2nd

Exp B: drew marble, did not put it back, drew a 2nd

P(y, g) = ?

Exp A: $p(y, g) = \frac{5}{10} \cdot \frac{4}{10} = \frac{20}{100} = .2$

Exp B: $p(y, g) = \frac{5}{10} \cdot \frac{4}{9} = \frac{20}{90} = .22$

Not the same - in Exp B the 2nd probability is higher because there are less marbles. It is a dependent situation.

12. a) $p(R, Y) = \frac{1}{2} \cdot \frac{1}{5} = \frac{1}{10}$

b) $p(B, B) = \frac{1}{4} \cdot \frac{3}{5} = \frac{3}{20}$

c) $p(E, B) = \frac{1}{4} \cdot \frac{3}{5} = \frac{3}{20}$

d) $P(R, B) = \frac{1}{2} \cdot \frac{3}{5} = \frac{3}{10}$

e) $P(E, E) = \frac{1}{4} \cdot 0 = 0$

13. Total # of books: 50

a) $P(\text{Poetry}) = \frac{4}{50} = .08$

b) $P(\text{Bio}) = \frac{10}{50} = .2$

c) $P(\text{Drama or Comedy}) = \frac{11}{50} = .22$

d) $P(\text{Sci-fi, Fantasy, Poetry}) = \frac{20}{50} = .4$

e) $P(\text{not Bio}) = \frac{40}{50} = .8$

14. a) $\frac{20}{60} = \frac{1}{3}$

b) $\frac{36}{360} = \frac{1}{10}$

c) $\frac{140}{360} = \frac{7}{18}$

d) $\frac{240}{360} = \frac{2}{3}$

15. a) $P(\text{spade}) = \frac{13}{52} = \frac{1}{4}$

b) $P(\text{not spade}) = \frac{39}{52} = \frac{3}{4}$

c) $P(9) = \frac{4}{52} = \frac{1}{13}$

d) $P(\text{red card}) = \frac{26}{52} = \frac{1}{2}$

e) $P(6 \text{ of } \diamondsuit) = \frac{1}{52}$

f) $P(j, q, k) = \frac{12}{52} = \frac{3}{13}$

g) $P(\text{ace}) = \frac{4}{52} = \frac{1}{13}$

Combinations, Perm, FCP

1. Combination

Dogs: A, B, C, D, E, F

$_6C_2 = 15$

A, B	✓	✓	✓	✓	✓
A, C	B, C	✓	✓	✓	✓
A, D	B, D	C, D	✓	✓	✓
A, E	B, E	C, E	D, E	✓	✓
A, F	B, F	C, F	D, F	E, F	✓

15 total ways for the dogs to escape

2. Permutation

$_4P_4 = 24$ letter arrangements

3. Combination

$_{10}C_4 = 210$ groups

4. FCP

$\underset{\text{\# of pants choices}}{\underline{5}} \cdot \underset{\text{\# of shirt choices}}{\underline{7}} = 35$ outfits/day $\quad \frac{35}{7} = \underline{5 \text{ weeks}}$

5. Permutation

$_{20}P_3 = 6{,}840$ sets of winners

6. Combination

$_5C_3 = 10$ ice cream cones

7. FCP

$\underset{\text{\# of bread choices}}{\underline{3}} \cdot \underset{\text{\# meat choices}}{\underline{2}} \cdot \underset{\text{\# of cheese choices}}{\underline{2}} = 12$ sandwiches

8. Combinations R, G, Y, O, B, P

$_6C_3 = 20$

R, G, Y	✓		
R, G, O	G, Y, O	Y, O, B	O, B, P
R, G, B	G, Y, B	Y, O P	1
R, G, P	G, Y, P	Y, B P	
R, Y, O	G, O, B	3	
R, Y, B	G, O P		
R, Y, P	G, B, P		
~~R, O,~~	6		
R, O, B			
R, O, P			
R, B, P			
10			

20 total groups

9. Permutation

$_8P_3 = 336$ governments

10.

Penny = 1¢	PND = 16¢
Nickle = 5¢	PNQ = 31¢
Dime = 10¢	PDQ = 36¢
Quarter = 25¢	NDQ = 40¢

Combination

$_4C_3 = 4$

11. a) Combination $_{15}C_3 = 455$

b) Permutation $_4P_4 = 24$

c) FCP

d) FCP

12. a) ${}_5P_5 = 120$

b) $\underline{\text{John}}$ $\underbrace{\underline{4} \cdot \underline{3} \cdot \underline{2} \cdot \underline{1}}_{{}_4P_4 = 24} = 24$

c) Permutations

13. a) ${}_7P_7 = 5040$

b) ${}_6P_6 = 720$ $\quad p(\text{onions 1st}) = \frac{720}{5040} = \frac{1}{7}$

c) $\frac{1}{5040}$

d) $\frac{5039}{5040}$

e) $\underline{6} \cdot \underline{5} \cdot \underline{\text{beans}} \cdot \underline{4} \cdot \underline{3} \cdot \underline{2} \cdot \underline{1}$

$= 720$

$p(\text{beans 3rd}) = \frac{720}{5040} = \frac{1}{7}$

14. a) ${}_{50}C_6 = 15{,}890{,}700$

b) $\frac{1}{15{,}890{,}700}$

15. a) ${}_{150}P_3 = 3{,}307{,}800$

b) ${}_{150}C_3 = 551{,}300$

16. ${}_6C_2 = 15$

${}_6C_4 = 15$