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2.2: Conditional probability

① a) $P(\text{Male}) = \frac{42}{80} = \frac{21}{40}$ b) $P(\text{French} \mid \text{Male}) = \frac{24}{42} = \frac{4}{7}$ c) $P(\text{Male} \mid \text{Spanish}) = \frac{18}{40} = \frac{9}{20}$

d) $P(\text{Spanish} \mid \text{Female}) = \frac{22}{38} = \frac{11}{19}$

② a)

Green spinner \ Yellow spinner	1	2	3	4
1	1	2	3	4
2	2	4	6	8
3	3	6	9	12
4	4	8	12	16

b) i) $P(X=8) = \frac{2}{16} = \frac{1}{8}$

ii) $P(X=6 \mid \text{Green spinner is 2}) = \frac{1}{4}$

iii) $P(\text{Yellow spinner is 2} \mid X=4) = \frac{1}{3}$

② a)

Dice 2 \ Dice 1	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	2	3	4	5	6
3	3	3	3	4	5	6
4	4	4	4	4	5	6
5	5	5	5	5	5	6
6	6	6	6	6	6	6

b) $\frac{7}{36}$ c) $\frac{4}{12} = \frac{1}{3}$ d) $\frac{1}{11}$

④

	Kickboxing	Yoga
Full	36	42
Weekend	33	31

a) i) $P(\text{Weekend} \mid \text{Yoga}) = \frac{31}{42+31} = \frac{31}{73}$

ii) $P(\text{Full} \mid \text{Kickboxing}) = \frac{36}{69} = \frac{12}{23}$ iii) $P(\text{Yoga} \mid \text{Full}) = \frac{42}{78} = \frac{7}{13}$

b) Not mutually exclusive. The total number of people in all of the classes is 142. So there are 22 members that go to both classes

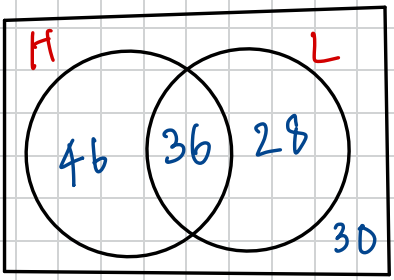
⑤ ~~1~~ ~~2~~ ~~3~~ 4 ~~5~~ 6 ~~7~~ 8 9 10 ~~11~~ 12 ~~13~~ 14 15 16 ~~17~~ 18 ~~19~~ 20

Prime numbers: 8 Total: 20 − 8 = 12

Square number: 4 $\Rightarrow \frac{4}{12} = \frac{1}{3}$

(6) a)

	H	H'	Total
L	36	28	64
L'	46	30	76
Total	82	58	140



b) i) $P(L') = \frac{46+30}{140} = \frac{19}{35}$

ii) $P(H' \cap L) = \frac{28}{140} = \frac{1}{5}$

iii) $P(H|L) = \frac{36}{64} = \frac{9}{16}$

iv) $P(L|H') = \frac{28}{58} = \frac{14}{29}$

c) $P(H \cap L) = P(H) \times P(L)$

$36 = 82 \times 64$

$\Rightarrow 36 \neq 5248$

Therefore L and H are not independent

(7) $\Rightarrow$ Total no. of guests = 540 Male: 290 Female: 250

Full breakfast = 320 Continental breakfast = 160

Guests who did not have breakfast $\Rightarrow 540 - (320 + 160) = 60$.

$\Rightarrow 60 - 20(\text{Female}) = 40$.

Male | Full breakfast = $290 - 75 - 40 = 175$ (Continental)

Female | Full breakfast = $320 - 175 = 150$

a) $P(C' \cap F') = \frac{60}{540} = \frac{1}{9}$

b) $P(M|C') \Rightarrow C' = 540 - 160 = 380$

$M \cap C' \Rightarrow \frac{215}{380} = \frac{43}{76}$

c) $P(F|M) = \frac{215 - 40}{290} = \frac{175}{290} = \frac{35}{58}$

d) $P((C' \cap F')|M) = \frac{60-20}{290} = \frac{40}{290} = \frac{4}{29}$

(8) a)

	Furina	Purskers	Whilix	Total:
Adults	11	17	10	38
Kittens	7	7	8	22
Total	18	24	18	60

b) i) $P(\text{Adult cat} \mid \text{Furina}) = \frac{11}{18}$ ii) $P(\text{Kitten} \mid \text{Whilix}) = \frac{8}{18} = \frac{4}{9}$

iii) $P(\text{Purskers} \mid \text{kitten}) = \frac{7}{22}$

c) Furina & Male $= \frac{1}{3}$ Purskers & Male: $\frac{2}{3}$ Whilix & Male $= \frac{1}{2}$

$$\Rightarrow \left(\frac{1}{3} \times \frac{18}{60}^{6}\right) + \left(\frac{2}{3} \times \frac{24}{60}^{8}\right) + \left(\frac{1}{2} \times \frac{18}{60}^{9}\right) \Rightarrow \frac{6+16+9}{60} = \frac{31}{60}$$