

Chapter 14

18. Census returns. [4 points] Let S = randomly selected person receives a short census, L = randomly selected person receives a long census and O = randomly selected person completes online. We are given that $P(S) = 0.8$, $P(L) = 0.2$, $P(S \text{ and } O) = 0.15$, $P(L \text{ and } O) = 0.04$ (4%)

a) $P(O) = P(S \text{ and } O) + P(L \text{ and } O) = 0.15 + 0.04 = 0.19$ (19%)

b) $P(S \text{ and } O) = 0.15$ (15%)

c) $P(S \text{ or } O) = P(S) + P(O) - P(S \text{ and } O) = 0.8 + 0.19 - 0.15 = 0.84$ (84%)

d) $P(S_c \text{ and } O_c) = P(S \text{ or } O)_c = 1 - P(S \text{ or } O) = 1 - 0.84 = 0.16$ (16%)

23. Movies. [4 points]

a) $51/240 = 0.2125$

b) $(31+38)/240 = 0.2875$

c) $(14+15)/240 = 0.1208$

d) $0.2875 + 0.2125 - 0.1208 = 0.3792$

Chapter 15

20. Death penalty. [4 points] Construct a two-way table of the conditional probabilities, including the marginal probabilities.

a) $P(\text{favour the death penalty})$

$$= 0.26 + 0.12 + 0.24$$

$$= 0.62$$

b)

$$P(\text{favour death penalty Republican}) =$$

$$P(\text{favour death penalty and Rep.})/P(\text{Republican})$$

$$= 0.26/0.30 = 0.867$$

Consider only the Republican row. The probability of favouring the death penalty is 0.26 out of a total of 0.30 for that row.

c)

$$P(\text{Democrat favour death penalty}) =$$

$$P(\text{Democrat and favour death penalty})/P(\text{favour death penalty})$$

$$= 0.12/0.62 = 0.194$$

Consider only the Favour column. The probability of being a Democrat is 0.12 out of a total of 0.62 for that column.

$$d) P(\text{Republican or favour death penalty}) = P(\text{Republican}) + P(\text{favour death pen.}) - P(\text{both})$$

$$= 0.30 + 0.62 - 0.26$$

$$= 0.66$$

The overall probabilities of being a Republican and favouring the death penalty are from the marginal distribution of probability (the totals). The candidate can expect 66% of the votes, provided her estimates are correct.

21. Movies. [4 points]

$$a) 15/38 = 0.3947$$

$$b) 15/51 = 0.2941$$

$$c) (21 + 22 + 38)/(69 + 46 + 56) = 81/171 = 0.4737$$

d)

$$P(\text{over 30|didn't select a comedy}) = P(\text{Over 30 and didn't select a comedy})/P(\text{didn't select a comedy})$$

$$= [(9 \cdot 7 \cdot 6 \cdot 39 \cdot 17 \cdot 12) / 240] / [(51 + 85) / 240]$$

$$= 90/136$$

$$= 45/68 = 0.6618$$

45. Drunks. Organize the information into a tree diagram.

a) $P(\text{Detain} | \text{Not Drinking}) = 0.2$

b)

$$P(\text{Detain})$$

$$= P(\text{Drinking and Det.}) + P(\text{Not Drinking and Det.})$$

$$= (0.12)(0.8) + (0.88)(0.2)$$

$$= 0.272$$

c)

$$P(\text{Drunk} | \text{Det.}) = P(\text{Drunk and Det.}) / P(\text{Detain})$$

$$= (0.12)(0.8) / [(0.12)(0.8) + (0.88)(0.2)]$$

$$= 0.353$$

d)

$$P(\text{Drunk} | \text{Release}) = P(\text{Drunk and Release}) / P(\text{Release})$$

$$= (0.12)(0.2) / [(0.12)(0.2) + (0.88)(0.8)]$$

$$= 0.033$$