

Part 7.1: Conditional Probability Exercise

1. This table shows data from the 2013 Census for New Zealand, and the number of males and females in each ethnicity group.

Ethnicity	Number of People		
	Male	Female	Total
European	1,135,746	1,250,496	2,386,242
Maori	184,923	211,362	396,285
Pacific Peoples	91,344	99,084	190,428
Asian	177,192	197,316	374,508
Middle Eastern/Latin American/African	17,763	17,211	34,974
Other ethnicity	32,376	22,656	55,032
Total	1,639,344	1,798,125	3,437,469

[data extracted on 05 Aug 2018 from NZ.Stat](#)

What is the probability a randomly chosen person

- Is male given they are of European descent?
- Is European given they are a male?
- Is either of Maori or Pacific descent, given they are female?

2. This table shows data from the 2013 Census for New Zealand, and the number of males and females and how long they have been living in their current residence.

Years at Residence	Number of People		
	Male	Female	Total
0 years	0.109	0.113	0.223
1-4 years	0.145	0.154	0.300
5-9 years	0.101	0.106	0.208
10-14 years	0.053	0.056	0.109
15-29 years	0.055	0.060	0.115
30 years or more	0.022	0.025	0.047
Total	0.486	0.514	1.000

[data extracted on 05 Aug 2018 from NZ.Stat](#)

What is the probability a randomly chosen person

- Is male given they have only lived in their current residence for less than 1 year?
- Who has lived in their house for more than 30 years is female?
- Has lived in their address for 5-14 years given they are female?

3. The table below shows the number of offences recorded during 2014 in New Zealand.

Offence	Number of Offences		
	Unresolved	Resolved	Total Recorded
Homicide and related offences	8	58	66
Acts intended to cause injury	11,036	28,908	39,944
Sexual assault and related offences	2,124	1,932	4,056
Dangerous or negligent acts endangering persons	303	434	737
Abduction, harassment and other related offences against a person	6,541	8,483	15,024
Robbery, extortion and related offences	1,279	861	2,140
Unlawful entry with intent/burglary, break and enter	46,801	6,464	53,265
Theft and related offences	93,453	25,870	119,323
Fraud, deception and related offences	4,556	4,481	9,037
Illicit drug offences	1,512	15,031	16,543
Prohibited and regulated weapons and explosives offences	620	5,171	5,791
Property damage and environmental pollution	28,927	11,431	40,358
Public order offences	5,469	21,282	26,751
Offences against justice procedures, government security and government operations	1,866	14,219	16,085
Miscellaneous offences	527	742	1,269
Total	205,022	145,367	350,389

[data extracted on 05 Aug 2018 from NZ.Stat](#)

- What is the likelihood of a homicide and related offences being unresolved?
 - What is the likelihood of an unresolved offence being a theft or related offence?
 - Given the offence is "unlawful entry with intent/burglary, break and enter", what is the probability it is resolved?
4. An insurance company does a survey of their customers (all of whom have either car or house insurance). They find the proportion of customers that have house insurance is 0.7, and the proportion that have both house and car insurance is 0.6.
- Given a person has house insurance what is the probability they have car insurance?
 - What is the probability they do not have house insurance, given they have car insurance?
5. At a restaurant one night 25 groups of people come through.
- All of them order something
 - None of them just order entrees
 - 2 groups have entrees, mains and desserts
 - 8 have both entrees and mains
 - 12 have entrees
 - 3 have both mains and desserts
 - 12 have desserts
- What is the probability
- A randomly chosen group had mains, given they had desert?
 - Given a group had an entrée, they also had desert?

6. Two students are chosen at random from a class of 12 boys and 13 girls to be office messengers / runners for the school for the day. What is the probability:
 - a. If the first student is a boy, the second is a girl?
 - b. The first student is a boy, given the second student is also a boy?
7. I have a standard pack of 52 cards
 - a. What is the probability, that given I have drawn two black cards out, the next one will also be black?
 - b. The next card is an Ace, given I have already drawn out 4 cards that were not aces?
8. Jane and Vikki are playing each other in tennis. The probability that Jane wins the first set is 0.5. If Jane wins a set the probability she wins the next set is 0.6, otherwise it is 0.35. In a women's tennis game you play the best of three sets, so you stop playing once one player has won two sets.
 - a. Vikki wins the second set, given Jane wins the first?
 - b. Given Jane wins the game overall, the game goes to three sets?

Part 7.1 Answers

- | | |
|--|-----------------------------------|
| 1a. $1,135,746 / 2,386,242 = 0.476$ (3sf) | 5a. $3 / 12 = 0.25$ |
| 1b. $1,135,746 / 1,639,344 = 0.693$ (3sf) | 5b. $6 / 12 = 0.5$ |
| 1c. $(211,362 + 99,084) / 1,798,125 = 0.173$ (3sf) | |
| 2a. $0.109 / 0.233 = 0.468$ (3sf) | 6a. $13 / 24 = 0.542$ (3sf) |
| 2b. $0.025 / 0.047 = 0.532$ (3sf) | 6b. $12 / 25 = 0.48$ |
| 2c. $(0.106 + 0.056) / 0.514 = 0.315$ (3sf) | |
| 3a. $8 / 66 = 0.121$ (3sf) | 7a. $24 / 50 = 0.48$ |
| 3b. $93,453 / 205,022 = 0.456$ (3sf) | 7b. $4 / 48 = 0.0833$ (3sf) |
| 3c. $6,464 / 53,265 = 0.121$ (3sf) | |
| 4a. $0.6 / 0.7 = 0.857$ (3sf) | 8a. 0.4 |
| 4b. $0.3 / 0.9 = 0.333$ (3sf) | 8b. $0.175 / 0.475 = 0.368$ (3sf) |