L2 Probability Practice #1

1. A company's boxes weigh 125 g on average with a standard deviation of 4.2 g.

   a) What is the probability that a box will weigh between 120 and 130 g?

   b) If 1200 boxes are shipped, how many should weigh more than 132 g?

   c) Discuss the likelihood that your answer in b) above is likely to be correct in the case of 1200 boxes actually being shipped?

   (You should assume the population statistics themselves are accurate.)

2. A survey of adult New Zealanders gave the following results:

	Under-weight	Normal	Over-weight	Obese	**Total**
Males	2	61	82	55	**200**
Females	3	76	65	56	**200**

   a) What proportion of females tested are overweight or obese?

   b) What is the probability that a male is selected, if it is known they are in the "normal" weight range?

   c) What is the relative risk that a male will not be in the normal range compared to females?

3. A set of ten cards, numbered consecutively from 1 to 10 is prepared.

   a) What is the probability that if two cards are dealt that they add up to 12?

   b) If two cards are dealt and they add up to 14, what is the probability one of the cards is a six?

   c) What is the probability that if four cards are dealt one after another that each card is one more than the one before? (e.g. 4, then 5, then 6, then 7)

Answers: L2 Probability Practice #1

1. A company's boxes weigh 125 g on average with a standard deviation of 4.2 g.

   a) Graphics normal distribution: Ncd: lower =120, upper = 130, σ = 4.2, μ = 125

   P(120 > x > 130) = **0.766**

   b) Graphics normal distribution: Ncd: lower =132, upper = 9999, σ = 4.2, μ = 125

   P(132 > x) = 0.04779. 1200 × 0.04779 = 57.35 **Predict 57 over 132 g**

   c) In real life there is always sample variability. So there would rarely be exactly 57 in any group of 1200. But it is the most likely result, and the answers for every lot of 1200 shipped would cluster around that value.

   Even though the mean and standard deviation may be correct, the distribution may not be normal, which can have a large effect on extreme values, such as we are calculating here.

2. A survey of adult New Zealanders gave the following results:

	Under-weight	Normal	Over-weight	Obese	**Total**
Males	2	61	82	55	**200**
Females	3	76	65	56	**200**

   a) 200 females. 65 + 56 = 121 o/w or obese. P(F = o/w or obese) = 121/200 = **0.605**

   b) 137 normal. 61 of them male. P(M given normal) = 61/137 = **0.445**

   c) P(M is not normal) = 139/200 = 0.695. P(F = not normal) = 124/200 = 0.620.

   Relative risk for males is 0.695/0.62 = **1.121**

3. A set of ten cards, numbered consecutively from 1 to 10 is prepared.

   a) There are 90 ways two cards can be dealt (= 10 for first × 9 for second)

   Eight of those options add up to 12 (2+10, 3+9, 4+8, 5+7, 7+5, 8+4, 9+3, 10+2)

   P(2 cards will add to 12) = 8/90 = **4/45** = **0.0889**

   b) Six options adding up to 14 are 4+10, 5+9, 6+8, 8+6, 9+5, 10+4.

   Two of these options have a six in it.

   P(a six in total of 14) = 2/6 = **1/3** = **0.333**

   c) There are seven ways the first card can be dealt which allows for the sequence to be complete (since any deal starting with 8,9 or 10 ends before 4 are dealt).

   After that each time there is only one of the remaining cards that which will complete the sequence.

   P(4 in a row) = 7/10 × 1/9 × 1/8 × 1/7 = **1/720** = **0.00139**