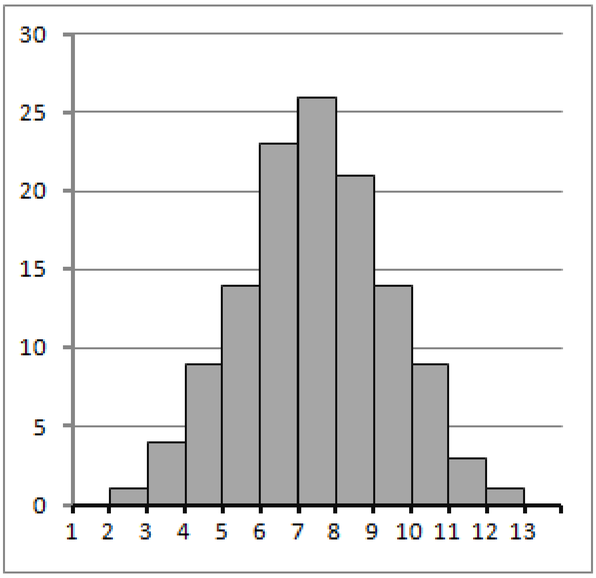
L2 Probability Revision #6

1. The length of time it takes to process orders at a takeaway shop is normally distributed, with a mean of 7.5 minutes and a standard deviation of 1.8 minutes.

   a) What is the probability that a customer will be served in less than 5 minutes?

   b) How fast are the quickest 5% of orders served?

   c) Calculate the mean and standard deviation of the distribution shown to the right. (n, sample size, = 125)



2. 81% of all customers order chips. 25% of all customers order hamburgers. 18% of all customers order both chips and hamburgers.

   a) What proportion of people order neither hamburgers nor chips?

   b) If a person orders chips, what is the probability that they will also order a hamburger?

   c) What is the probability that a person not ordering chips doesn't order a hamburger?

3. The takeaway conducts a customer satisfaction survey. On the first day the customers are asked to rate the speed, and on the second day they are asked about quality:

	Speed	Quality
Happy	83	92
Neutral	17	8
Unhappy	12	5

   a) What proportion of customers are unhappy with the quality of the food?

   b) If a customer said they were unhappy, what it the probability it was about the speed?

   c) What is the relative risk that a customer will be unhappy with the speed of service compared to being unhappy with the quality of the food? Why is this a better measure of customer satisfaction than the probability calculated in b)?

Answers: L2 Probability Revision #6

1.

a) Graphics normal distribution: Ncd: lower = -9999, upper = 5, σ = 1.8, μ = 7.5

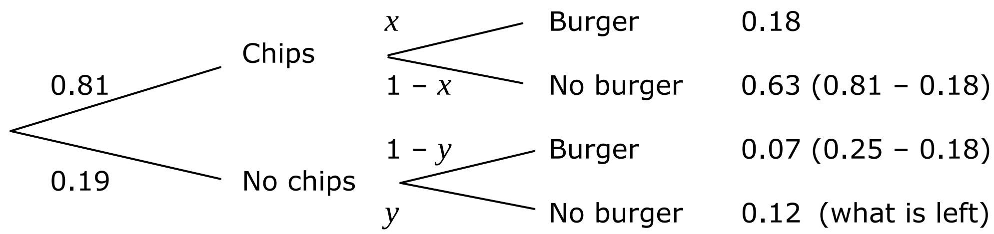
P(x > 200) = **0.0824**

b) Graphics: InvN: tail = left, area = 0.05, σ = 1.8, μ = 7.5, = 4.539 = **4.5 minutes**

c) μ = almost exactly middle of 7 – 8 band with such symmetry, **μ = 7.5**

5% of 125 = 6.25, so the ±2σ bounds are from slightly less than 3.5 to 11.5
4σ = 11.5 – 3.5 which solves to give **σ = 2 approximately**
(Using ±1σ = 68% = 85 values, we get 2σ = 9.5 – 5.5, so again σ = 2 approx)

2.



a) We are given that 18% order chips and burgers. Since 81% order chips, there must be 63% left over with chips but no burgers. If 25% order burgers, but only 18% with chips then 7% order no chips with their burger, leaving from 100% a total of **12% with neither**

b) 81% order chips, of which 18% order a hamburger.

P(burger if chips) = $^{0.18}/_{0.81}$ = $\mathbf{^{2}/_{9}}$ = **0.2222**

c) 19% don't order chips, of which 12% order a hamburger.

P(no burger if no chips) = $^{12}/_{19}$ = **0.6316**

Or, using the tree, we need to calculate y: 0.19 × y = 0.12 ⇒ y = 0.6316

3.

	Speed	Quality	
Happy	83	92	175
Neutral	17	8	25
Unhappy	12	5	17
	112	105	217

a) Of 105 surveyed, 5 were unhappy with quality = $^{5}/_{105}$ = $\mathbf{^{1}/_{21}}$ = **0.0476**,

b) 17 people rated unhappy, of which 12 were for speed = $^{12}/_{17}$ = **0.706**

c) Risk of unhappy with for speed = $^{12}/_{112}$ = 0.1071 and for quality = $^{5}/_{105}$ = 0.0476

Relative risk for speed = 0.1071 ÷ 0.0476 = 2.25. **The risk is 2½ times higher**

This is a better measure than b) because the effect of sample size is cancelled out in relative risk but affects the result in calculations like b) so the fact that the more people were surveyed about speed affects its weighting in the answer.