L2 Probability Practice #5

1. Scientists compare a new drug to see if it can better help people quit cocaine addiction. They compare results with the old drug, and also with a non-drug therapy. They divide the results into three groups, depending on how long they stayed off the drug.

	Less than one month clean of cocaine	Last between one and three months	Clean after more than three months
Old drug	50	12	9
New drug	41	18	16

   a) What is probability that the new drug will enable an addict to stay off cocaine for at least one month?

   b) What is risk that a patient on the new drug will manage to stay off for one month but won't be able to stay off for three months?

   c) What is the relative rate of long term success (staying off for more than three months) of the new drug compared to the old one?

2. The makers of marijuana testing kit conduct an experiment to see how sensitive it is. They conduct a test on irregular users who smoke the drug. They find that that an irregular user will be detected as having smoked marijuana a mean of 13.1 days after their last use, with a standard deviation of 3.3 days:

   a) What is the probability an irregular user will test positive 20 days after last using?

   b) How long would an irregular user have to wait after using to be 95% sure that they would pass the test?

   c) What would the median and interquartile range for the test be for irregular use?

3. A factory considers testing all its staff for "P" usage. The company suspects about 5% of its staff use "P". The first test is cheap, and not particularly reliable.
   - There is a 2% false positive rate, where a person tests positive even when they aren't.
   - There is an 5% false negative rate, where a person should test positive, but doesn't.

   a) If the factory employs 280 staff, how many positive tests should they expect? (Assume the factory is correct that 5% are using the drug.)

   b) What is the probability that a person testing positive hasn't actually has used P?

   c) If an employee fails the first test, they must take a second confirmation test. That has a false positive rate of 0.5%, and a false negative rate of 2%. What is the probability a person who has not used P will end up testing positive twice?

Answers: L2 Probability Practice #5

1.

a) There are 41 + 18 + 16 = 75 people tested. 18 + 16 = 34 stay off for 1 month.
P(stay off for a month) = 34/75 = **0.453**

b) 34 stay off for at least one month, but 18 of those relapse before 3 months
P(will make 1 but not 3 months) = 18/34 = **0.529**

c) P(old drug 3+ months) = 9/71 = 0.1268. P(new drug 3+ months) = 16/75 = 0.2133
Relative rate of success of new drug = 0.2133/0.1268 = **1.68**

2.

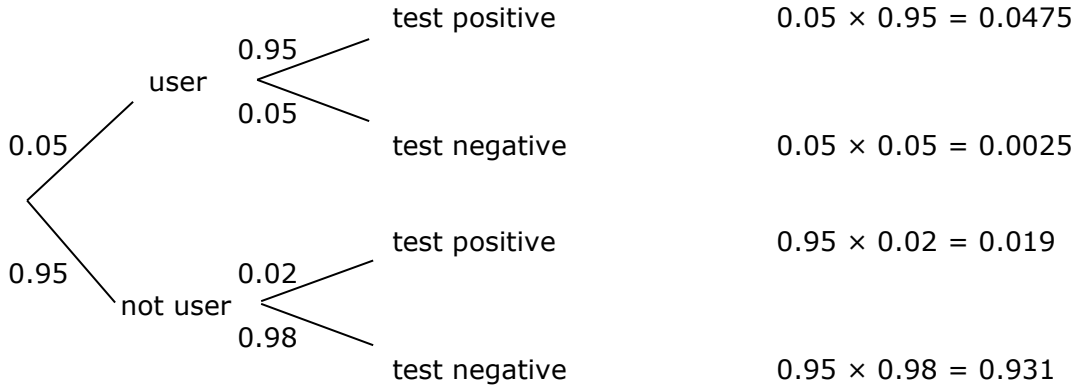
a) Graphics: Ncd: lower = 20, upper = 99999, σ = 3.3, μ = 13.1, P(x > 20) = **0.0183**

b) Graphics: InvN: tail = left, area = 0.95, σ = 3.3, μ = 13.1, time = **18.5 days**

c) **Median = 13.1 days** (median = mean for a normal distribution).

InvN: tail = centre, area = 0.5, σ = 3.3, μ = 13.1, **IQR = 10.9 – 15.3 days**
(With older calculators with only left tail: area = 0.25, then area = 0.75.)

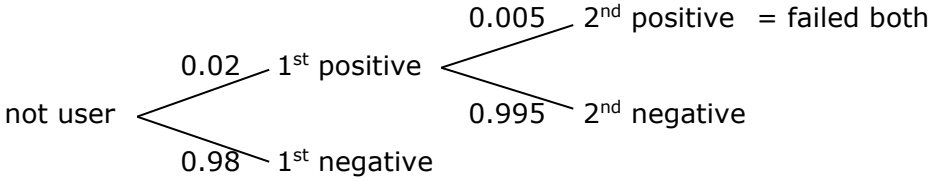
3.



a) P(true +) + P(false +) = 0.0475 + 0.019 = 0.0665280 × 0.0665 = 18.62.
No fractional people: they should expect **19 positive tests**

b) P(false +) = 0.019 out of the chance of P(true or false +) = 0.0665

P(a positive is actually false) = 0.019/0.0665 = **0.2857**
(i.e. 28.6% of positive tests will be wrong.)



c) For a person who doesn't use to fail both tests is P(fail 1st) × P(fail 2nd)

So P(non-user fail both) = 0.02 × 0.005 = **0.0001**