

Recognising distributions

1. On a campus there are 100 dogs of which 20 are white.
 - (a) On a certain day you spot 30 dogs what is the probability that 10 of them are white (write the formula)?
 - (b) What would be the number of white dogs that you expected to see?
 - (c) On another day you keep spotting dogs until you see a white dog. How many dogs would you (expect) to have spotted before you see a white dog?
2. A chemist is asked to examine a large number of samples of a product from a factory. She decides to keep examining samples until she finds 10 defective samples; at this point she has examined 150 samples (including the 10 defective ones).
 - (a) How many defective samples do you expect to find in a batch of 500 samples?
 - (b) If she had only looked for 3 defective samples, how many samples could she expect to have examined?
 - (c) If the chemist was asked to make a box of 200 good samples how many samples would she need to examine?
3. The police commissioner has reliable information that 10 dangerous criminals have come into the area. He sends 1000 policemen to various places in the city to look for them.
 - (a) Write the formula for the probability that 5 of the policemen report back that they have seen the criminals.
 - (b) The commissioner now asks a large number of citizens to help in the process. Estimate the probability that no criminal is caught.
 - (c) Estimate the probability that at most 5 criminals are caught.
4. Suppose that astronomers have estimated that about 10 stars in a galaxy become supernovas each year (52 weeks). A supernova can be spotted for at least a week after it explodes. An astronomer has access to a satellite that records a picture of the galaxy once every week.
 - (a) How many weeks can the astronomer expect to wait before the satellite records a supernova?
 - (b) Write the formula for the probability that the astronomer will spot a supernova within one month (four weeks).
 - (c) The astronomer gets a grant to get him pictures every day (1 week is 7 days) from the satellite. Write the formula that the astronomer will spot the supernova within one month (28 days).
 - (d) Estimate the above answers numerically. Was the effort involved in writing the grant application worth it?