

Week 2 – Problems

1. Find (a) the mean and standard deviation, (b) the median and inter-quartile range, of the following data set:

{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

Would you say that either summary set is preferable to the other?

If the number 10 is replaced by the number 100 so that the data set becomes {1, 2, 3, 4, 5, 6, 7, 8, 9, 100},

calculate the same statistics again and comment on which set you would use to summarise the data.

2. A lecturer gives a science test to two classes and calculates the results as follows:

- Class A – average mark 36%
- Class B – average mark 40%

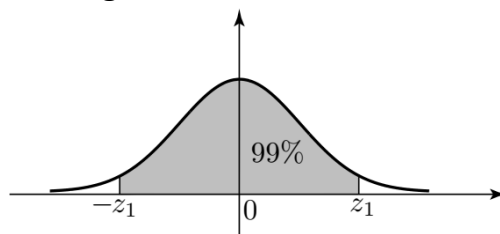
The lecturer reports to her Head of Department that the average mark over the two classes must be 38%. The Head of Department disagrees, who is right? Do you need any additional information, if so what, to decide as to who is right?

3. The following data give the lifetimes in hours of 50 electric lamps.

1337	1437	1214	1300	1124	1065	1470	1488	1103	978
1177	1289	1045	947	969	1339	1594	812	1277	1032
1167	974	1131	974	1727	1378	1385	1330	1672	1604
1493	1521	1235	1682	1136	1229	803	1166	1494	1733
978	1110	1055	1438	1436	1424	766	1283	829	1652

- (a) Represent the data using a stem-and-leaf diagram with two-digit leaves.
(b) Calculate the mean lifetime from these data.
(c) Does the mean lifetime give a good indication of the expected lifetime of a lamp?

- 4.** Packages have a nominal net weight of 1 kg. However, their actual net weights have a uniform distribution over the interval 980 g to 1030 g.
- Find the probability that the net weight of a package is less than 1 kg.
 - Find the probability that the net weight of a package is less than w g, where $980 < w < 1030$.
 - If the net weights of packages are independent, find the probability that, in a sample of five packages, all five net weights are less than w g and hence find the probability density function of the weight of the heaviest of the packages. (Hint: all five packages weigh less than w g if and only if the heaviest weighs less than w g).
- 5.** The time intervals between successive barges passing a certain point on a busy motorway have an exponential distribution with mean 8 minutes.
- Find the probability that the time interval between two successive barges is less than 5 minutes.
 - Find a time interval t such that we can be 95% sure that the time interval between two successive barges will be greater than t .
- 6.** If a random variable X has a standard normal distribution find the probability that it assumes a value:
- less than 2.00
 - greater than 2.58
 - between 0 and 1.00
 - between -1.65 and -0.84
- 7.** Find the 99% probability interval for Z about its mean, i.e. the value of z_1 in the diagram:



The shaded area is 99% of the total area

- 8.** What is the 99% probability interval for the lifetime of a bulb when the lifetimes of such bulbs are normally distributed with a mean of 2000 hours and standard deviation of 40 hours?
- 9.** The diameter of an electric cable is normally distributed with mean 0.8 cm and variance 0.0004 cm^2 .
- (a) What is the probability that the diameter will exceed 0.81 cm?
 - (b) The cable is considered defective if the diameter differs from the mean by more than 0.025 cm. What is the probability of obtaining a defective cable?
- 10.** The time taken by a team to complete the assembly of an electrical component is found to be normally distributed, about a mean of 110 minutes, and with a standard deviation of 10 minutes.
- (a) Out of a group of 20 teams, how many will complete the assembly:
 - (i) within 95 minutes.
 - (ii) in more than 2 hours.
 - (b) If the management decides to set a 'cut off' time such that 95% of the teams will have completed the assembly on time, what time limit should be set?
- 11.** Nuts and bolts are made separately and paired at random. The nuts' diameters, in mm, are independently $N(10, 0.02)$ and the bolts' diameters, in mm, are independently $N(9.5, 0.02)$. Find the probability that the bolt is too large for its nut.