The Normal Probability Distribution - Tutorial Sheet A

1. Assume that Z scores are normally distributed with a mean of Zero and a standard deviation of 1

   (i) $P(0 < Z < a) = 0.1915$ Find a

   (ii) $P(-b \leq Z \leq b) = 0.90$ Find b

   (iii) $P(-c \leq Z \leq c) = 0.99$ Find c

   (iv) $P(Z \leq d) = 0.3085$ Find d

2. Given the following information calculate the value of z_1 and z_2 using the normal tables. $P(Z \geq z_2) = 0.0045$ and $P(z_1 \leq Z \leq z_2) = 0.0205$

3. Assume that the length of injected moulded plastic components are normally distributed with a mean of 10mm and a standard deviation of 2mm. Draw a rough sketch and then calculate corresponding probability for the following measurements occurring on an individual component:

   (a) Between 10 and 12.4mms

   (b) Less than 9.7 mms

   (c) Between 9.8 and 10.1 mms

   (d) Less than 10.3 mms

4. The gestation period is approximately normally distributed with a mean of 275 days and a standard deviation of 4 days. Estimate the probability that the gestation period is

   (a) greater than 280 days

   (b) less than 265 days

   (c) between 272 and 283 days.

   (d) What gestation period is surpassed by 2.5% of the population?

5. The length of the jump of an athlete has a normal distribution with mean 7m and standard deviation 0.1m. Calculate the probability that she jumps

   (a) at least 7.15m

   (b) no more than 7.15m

   (c) between 7.1m and 7.20m

   (d) Find the probability that if she jumps 3 times all the jumps will be less than 7.15m (assume the lengths of the jumps are independent).

6. The amount of time required for routine automobile transmission service is normally distributed with the mean 45 minutes and the standard deviation 8.0 minutes. The service manager plans to have work begin on the transmission of a customers car 10 min after the car is dropped off, and the customer is told that the car will be ready within 1 hour total time (i.e. after the car is dropped off). What is the probability that the service manager will be wrong?

7. The weight of shire horses is assumed to have a normal distribution with mean 1000kg and standard deviation 50kg.

(a) Calculate the probability that the mass of a shire horse is more than 970kgs.

(b) Calculate the probability that the mass of a shire horse is no more than 1035kg.

(c) Calculate the probability that the mass of a shire horse is between 945kg and 1035kg.

(d) What weight is exceeded by 2.5% of shire horses?

8. The lifetime of an electrical component is known to follow a normal distribution with a mean of 2,000 hours and a standard deviation of 200 hours. Compute the probability that a randomly selected component will last

(a) more than 2,220 hours,

(b) between 2,000 and 2,400 hours.

9. A Physical Education teacher in a secondary school is marking performance of students on the high jump coming up to their end of year exams. For the given age group published data suggest a mean jumping height of 1.5m and standard deviation of 10cm and the data are considered to be normally distributed. The teacher wishes to distribute marks according to the normal curve and have the following proportions allotted for grades.

A	B	C	D	
20%	64%	14%	2%	(100%)

Draw a sketch of the normal distribution. On the axis mark the mean height. Calculate what heights will be required in order for students to attain the A, B, C and D grades. Mark these onto your sketch.