2.1 Easy Problems On The Normal Distribution

Example N° 1
The weights of packets of *Wooferific*™ dog biscuits are normally distributed with mean 625 g and standard deviation 15 g. What is the probability that the contents of a randomly selected packet of *Wooferific*™ weigh more than 630 g ?

Example N° 2
The time in seconds to react to an emergency alarm in an aircraft simulator is found from experience to be normally distributed with $X \sim N(\,1.64, 0.7^{\,2}\,)$.
Pilots with the quickest 4% of reaction times are said to be 'sharp'.
(**i**)　　What is the longest reaction time that will result in a pilot being 'sharp' ?

Pilots with the slowest 4% of reaction times are said to be 'wrecked'.
(**ii**)　　What is the shortest reaction time that will result in a pilot being 'wrecked' ?

2.2 Exercise

Question 1
The volume of anti-bacterial hand wash dispensed by an anti-bacterial hand wash dispenser on each press, X ml, is modelled as $X \sim N(8, 0.6^2)$.

Find **(i)** $P(X > 9)$

  (ii) $P(X < 8.4)$

Question 2
Boxes of chocolate with mean weight 1 kg are produced.
It is decided that all boxes weighing less than 990 g will be repacked.
Also, all boxes weighing more than 1050 g will be repacked.
If the weights of the boxes is normally distributed with standard deviation 20 g, what proportion of boxes are repacked ?

HINT : Draw a diagram and try to spot the 'clever' way of answering this question.

Question 3

S1 Examination question from June 2003, Q2

The lifetimes of batteries used for a computer game have a mean of 12 hours and a standard deviation of 3 hours.

Battery lifetimes may be assumed to be normally distributed.

Find the lifetime, *t* hours, of a battery such that 1 battery in 5 will have a lifetime longer than *t*.

[6 marks]

Question 4

S1 Examination question from June 2005, Q6

A scientist found that the time taken, *M* minutes, to carry out an experiment can be modelled by a normal random variable with mean 155 minutes and standard deviation 3.5 minutes

Find   (**a**) $P (M > 160)$

[3 marks]

(**b**) $P (150 \leqslant M \leqslant 157)$

[4 marks]

(**c**)   the value of *m* to 1 decimal place, such that $P (M \leqslant m) = 0.30$

[4 marks]

Question 5

S1 Examination question from June 2007, Q6

The random variable *X* has normal distribution with mean 20 and standard deviation 4

(a)   Find $P (X > 25)$

[3 marks]

(b)   Find the value of *d* such that $P (20 < X \leqslant d) = 0.4641$

[4 marks]

Question 6

S1 Examination question from May 2011, Q4

Past records show that the times, in seconds, taken to run 100 m by children at a school can be modelled by a normal distribution with a mean of 16.12 and a standard deviation of 1.60

A child from the school is selected at random

(a)   find the probability that this child runs 100 m in less than 15 s

[3 marks]

On sports day the school awards certificates to the fastest 30% of children in the 100 m race

(b)   Estimate, to 2 decimal places, the slowest time taken to run 100 m for which a child will be awarded a certificate

[4 marks]

Question 7

A manufacturer fills jars with coffee.

The weight of coffee, *W* grams, in a jar can be modelled by a normal distribution with mean 232 grams and standard deviation 5 grams

(a)　　Find $P (W < 224)$

[3 marks]

(b)　　Find the value of *w* such that $P (232 < W < w) = 0.20$

[4 marks]

Two jars of coffee are selected at random

(c)　　Find the probability that only one of the jars contains between 232 grams
　　　　and *w* grams of coffee

[3 marks]

Question 8

S1 Examination question from June 2014, Q7

The heights of adult females are normally distributed with mean 160 cm and standard deviation 8 cm

(a)   Find the probability that a randomly selected adult female has a height greater than 170 cm

[3 marks]

Any adult female whose height is greater than 170 cm is defined as tall

An adult female is chosen at random.
Given that she is tall,

(b)   find the probability that she has a height greater than 180 cm

[4 marks]

Half of tall adult females have a height greater than h cm

(c)   find the value of h

[5 marks]