Lecture 9 Exercises

9.1 Suppose the lifetime of an electrical component follows a uniform distribution on the range $[0, 2000]$ hours.

a) Draw a sketch of the distribution.

b) Find the probability that the lifetime will be,

(i) at least 1000 hours

(ii) less than 250 hours

(iii) between 500 and 1500 hours

(draw a sketch of the distribution and the area under the distribution representing the probability)

9.2 The time taken (in minutes) to serve a customer in a fast food restaurant is a continuous random variable, X, with probability distribution,

$$f(x) = \begin{cases} \frac{x}{2} & 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

a) Sketch the distribution. (Hint: It's often referred to as a triangular distribution)

b) Show that the area under the distribution is one. (in case you've forgotten, the area of a right-angled triangle is base$\times$height$\div$2.)

c) You only need to use the areas of triangles to answer these questions. Find the probability that the time taken to serve a customer will be,

(i) less than one minute

(ii) more than one minute

(iii) more than 30 seconds

(iv) between 30 seconds and 1 minute.

9.3 Use standard Normal tables to find the following probabilities, (draw a sketch diagram in each case)

a) $P(Z > 1.7)$

b) $P(Z > 2.35)$

c) $P(Z < -0.92)$

d) $P(Z < -2.33)$

e) $P(0.78 < Z < 2.56)$

f) $P(-1.99 < Z < -0.34)$

g) $P(-1.67 < Z < 2.58)$

9.4 The lifetime of a certain brand of lightbulb is Normally distributed with mean 2000 hours and standard deviation 75 hours. Find the probability that a randomly selected bulb will have lifetime,

a) greater than 2100 hours
b) greater than 2200 hours
c) less than 2050 hours
d) less than 1950 hours
e) between 1950 and 2100 hours
f) between 2050 and 2200 hours
g) between 1900 and 1950 hours

9.5 Bags of sugar packed by a machine have a mean weight of 2kg and a standard deviation of 0.02kg. Find the probability that the weight of a bag will be

a) greater than 2.05kg
b) less than 1.96kg
c) between 1.95 and 2.05kg
d) less than 2.03kg
e) between 1.95 and 1.98 kg
f) between 2.01 and 2.05 kg

9.6 A type of laboratory mouse has weight which is Normally distributed with mean 30g and standard deviation 2.5g. Find the probability that the weight of a randomly selected mouse is,

a) at least 33g
b) less than 33.5g
c) more than 29g
d) less than 28g
e) between 27g and 33g
f) between 31g and 33.5g

9.7 Eggs are classified as standard, if they weigh less than 46.0g, medium if they weigh between 46.0g and 56.0g, or large if they weigh over 56.0g. Suppose the eggs laid by a particular breed of hen have weight which is Normally distributed with mean 50.0g and standard deviation 5.0g. What percentage of eggs laid by these hens falls into the three classes?

9.8 A manufactured item requires a fuse which can be supplied by one of two suppliers. Supplier 1's fuses have a lifetime which is Normally distributed with mean 1000 hours and standard deviation 30 hours. Supplier 2's fuses have a lifetime which is Normally distributed with mean 990 hours and standard deviation 10 hours. Your product specification requires that fuses should last at least 980 hours. Which of the two suppliers would you choose and why.