Introductory Statistics Tutorial Answers
Chapter 6 – Continuous Random Variables

Section A: Probability Density Function Quiz

1. Areas under the density curve represent probabilities. The probability that a random observation falls between a and b is equal to the area between the density curve and the x-axis from $x = a$ and $x = b$.

2. The total area under the curve equals 1.

3. No, because for a continuous random variable:

    $\text{pr}(a \leq X \leq b) = \text{pr}(a < X \leq b) = \text{pr}(a \leq X < b) = \text{pr}(a < X < b)$ = area under the curve between a and b.

4. The parameters are μ and σ.

Section B: Normal Distribution

1. **(a)** $\text{pr}(X < 245) = 0.0947$
   (b) $\text{pr}(255 < X < 280) = \text{pr}(X < 280) - \text{pr}(X < 255) = 0.8092 - 0.2459 = 0.5633$
   (c) $\text{pr}(X > 287) = 1 - \text{pr}(X < 287) = 1 - 0.9053 = 0.0947$

2. Let X be the survival time in months of a cancer patient on this drug.
   (a) $\text{pr}(X > x) = 0.8$ therefore $\text{pr}(X < x) = 0.2$ and so $x = 17.6341$.
       80% of the patients live beyond 17.6 months.
   (b) $\text{pr}(a < X < b) = 0.8$
       $\text{pr}(X < a) = 0.1$ and so $a = 10.5932$
       $\text{pr}(X < b) = 0.9$ and so $b = 51.6048$
       The range of the central 80% of survival times is from 10.6 to 51.6 months.

3. Let X be the maximum distance reached by a pilot without moving the seat.
   (a) $\text{pr}(X \geq 120) = 1 - \text{pr}(X \leq 120) = 1 - 0.3085 = = 0.6915$
   (b) $\text{pr}(X \geq x) = 0.95$ therefore $\text{pr}(X < x) = 0.05$ and so $x = 108.5515$.
       The maximum distance at which the switch should be placed is 109cm.
   (c) (i) That this pilot's maximum reach is 1.5 standard deviations above the mean.

   (ii) $x = 125 + 1.5 \times 10 = 140$cm. A z-score of 1.5 corresponds to a maximum reach of 140cm.