MATH1001 Homework Solution

Chapter 5

5.1.1

There are three possible total costs in excess of \$125,000 when sampling n = 3 patients as listed in Table 5.1.2: \$130,000, \$155,000, and \$180,000. Thus,

$$\begin{aligned}
\Pr\{\text{total cost} > \$125{,}000\} &= \Pr\{\text{total cost} = \$130{,}000\} + \Pr\{\text{total cost} = \$155{,}000\} \\
&\quad + \Pr\{\text{total cost} = \$180{,}000\} \\
&= 12/64 + 6/64 + 1/64 \\
&= 19/64 = 0.2969
\end{aligned}$$

5.1.5

To compute the sampling distribution for the total weight of samples of two dogs, we first must list all possible samples of two dogs and compute the total weight for each possible sample. The following table displays the weights of two dogs for all 16 possible samples of two dogs and their total weights.

Dog 1	Dog 2	Total Weight
42	42	84
42	48	90
42	52	94
42	58	100
48	42	90
48	48	96
48	52	100
48	58	106
52	42	94
52	48	100
52	52	104
52	58	110
58	42	100
58	48	106
58	52	110
58	58	116

Tabulating the unique total weights, the sampling distribution of the total weight is summarized in the following table.

Total Weight	Frequency	Probability
84	1	1/16
90	2	2/16
94	2	2/16
96	1	1/16
100	4	4/16
104	1	1/16
106	2	2/16
110	2	2/16
116	1	1/16
	16	16/16

5.2.4

(a) In the population, μ = 155 and σ = 27.

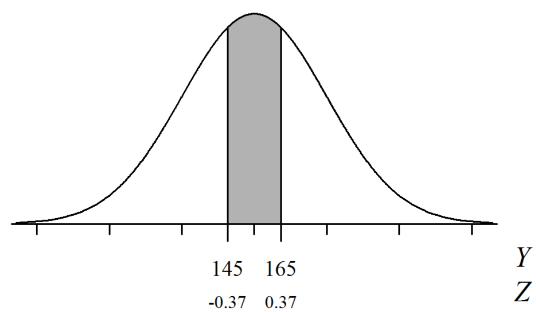
For y = 165,

$z = \frac{y - \mu}{\sigma} = \frac{165 - 155}{27} = 0.37.$

From Table 3, the area below 0.37 is 0.6443.

For y = 145,

$z = \frac{y - \mu}{\sigma} = \frac{145 - 155}{27} = -0.37.$



From Table 3, the area below -0.37 is 0.3557.

Thus, the percentage with 145≤ y ≤ 165 is

0.6443 – 0.3557 = 0.2886, or 28.86%.

(b) We are concerned with the sampling distribution of $\bar{Y}$ for n = 9. From Theorem 5.2.1, the mean of the sampling distribution of $\bar{Y}$ is

$\mu_{\bar{Y}}$ = μ = 155,

the standard deviation is

$\sigma_{\bar{Y}} = \frac{s}{\sqrt{n}} = \frac{27}{\sqrt{9}} = 9,$

and the shape of the distribution is normal because the population distribution is normal (part 3a of Theorem 5.2.1).

We need to find the shaded area in the figure.

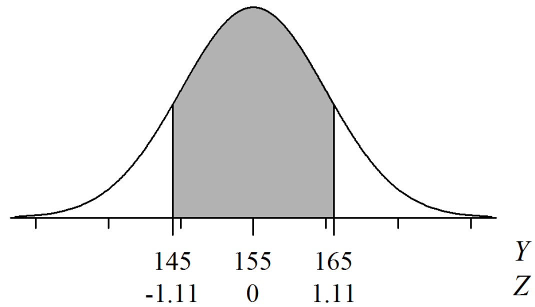
For $\bar{y} = 165$,

$$z = \frac{\bar{y} - \mu_{\bar{Y}}}{\sigma_{\bar{Y}}} = \frac{165 - 155}{9} = 1.11.$$

From Table 3, the area below 1.11 is 0.8665.

For $\bar{y} = 145$,

$$z = \frac{\bar{y} - \mu_{\bar{Y}}}{\sigma_{\bar{Y}}} = \frac{145 - 155}{9} = -1.11.$$



From Table 3, the area below -1.11 is 0.1335.

Thus, the percentage with $145 \le \bar{y} \le 165$

is 0.8665 - 0.135 = 0.7330, or 73.30%.

(c) The probability of an event can be interpreted as the long-run relative frequency of occurrence of the event (Section 3.2). Thus, the question in part (c) is just a rephrasing of the question in part (b). It follows from part (b) that

$\Pr\{145 \le \bar{Y} \le 165\} = 0.7330$.

5.2.14

(a) $\mu_{\bar{Y}} = \mu = 162$.

(b) $\sigma_{\bar{Y}} = 18/\sqrt{9} = 6$

5.2.19

$\mu_{\bar{Y}} = 38$ and $\sigma_{\bar{Y}} = 9/\sqrt{25} = 1.8$.

(a) $z = \frac{36 - 38}{1.8} = -1.11$. Table 3 gives 0.1335, so $\Pr\{\bar{Y} > 36\} = 1 - 0.1335 = 0.8665$.

(b) $z = \frac{41 - 38}{1.8} = 1.67$. Table 3 gives 0.9525, so $\Pr\{\bar{Y} > 41\} = 1 - 0.9525 = 0.0475$.