Chapter 17, Review Problem 7:

(a) If the sum of the draws is 321, then the average is $321/100 = 3.21$.

(b) If the average of the draws is 3.78, then the sum is $3.78 \times 100 = 378$.

(c) The average of the draws is between 3 and 4 if and only if the sum of the draws is between 300 and 400, so $P(3 \leq \text{avg} \leq 4) = P(300 \leq \text{sum} \leq 400)$.

To estimate this probability we use the *Normal Approximation*

i. The average of the box is $A = \dfrac{1+2+3+4+5+6}{6} = 3.5$, so the expected value for the sum is $EV = 100 \cdot 3.5 = 350$.

ii. The standard deviation of the box is

$$SD = \sqrt{\frac{(1-3.5)^2 + (2-3.5)^2 + (3-3.5)^2 + (4-3.5)^2 + (5-3.5)^2 + (6-3.5)^2}{6}} \approx 1.7,$$

so the standard error for the sum is $SE \approx \sqrt{100} \cdot 1.7 = 17$.

It follows that

$$\begin{aligned} P(3 \leq \text{avg} \leq 4) = P(300 \leq \text{sum} \leq 400) \\ \approx \text{ area under the normal curve between } z_0 \text{ and } z_1 \end{aligned}$$

where

$$z_1 = \frac{400-350}{17} \approx 2.94 \quad \text{and} \quad z_0 = \frac{300-350}{17} \approx -2.94 = -z_1.$$

Conclusion: $P(3 \leq \text{avg} \leq 4) \approx 99.67\%$

(From the normal table entry for 2.95, adjusted down a tiny bit).

Chapter 17, Review problem 10:

False. If in n draws the expected sum is 400, then in $2n$ draws, the expected sum will be 800, this much is true. On the other hand, the $SE(\text{sum})$ does not double, when the number of draws doubles — it only increases by a factor of $\sqrt{2}$, i.e.,

$$SE(\text{sum of } 2n \text{ draws}) = SE(\text{sum of } 2n \text{ draws}) \cdot \sqrt{2} \approx 1.4 \cdot SE(\text{sum of } n \text{ draws}).$$

So, if a margin of error of ± 50 around 400 gives a probability of 75% for n draws, then a margin of error of $\sqrt{2} \cdot 50 \approx 70$ around 800 will give the same probability:

$$P(730 < \text{sum of } 2n \text{ draws} < 870) \approx 75\%,$$

which means that $P(700 < \text{sum of } 2n \text{ draws} < 900)$ will be noticeably bigger than 75% (about 90%, actually).

Chapter 18, Review problem 5:
The histogram (i) is the probability histogram for the *sum* of the draws, because it looks approximately normal. The histogram (iii) is the (data) histogram for the numbers drawn (1, 2 or 3), because it has only 3 bars. This means that (ii) is the probability histogram for the *product* of the draws.

Chapter 19, Review problem 6.

No. This is not a probability sample, because it would be very hard (probably impossible) to estimate the probability of different types of students walking through the the main campus plaza at any given time. The fact that 'different times' were specified doesn't make it more scientific or probabilistic.

It is essentially a convenience sample.