1. (ii). Non-negative variable, average $- 2\text{SD}$ is negative.

2. (iii). The data indicate that the distribution has a long right hand tail; a small number of students have a large number of math classes.

3. $z = 3.46$. SE for difference $= 7.21\%$

4. (ii)

5. \(\binom{100}{30}0.3^{30}0.7^{70}\).

6. 7.97\%. Expect 30 blue tickets, SE 4.58, $z = 0.11$.

7. (i). The chance of hitting the theoretical probability exactly will decrease.

8. (ii) At least 79. This is the 80th percentile of the midterm distribution.

9. 85.8.

10. 78.82\%. The rms error is 8.43.

11. (ii) There’s a perfectly good random sample but the two sets of responses are dependent because they are obtained from the same people. There is no information about the nature of the dependence.

12. The box has 15,000 tickets, one for each patient. Each ticket shows blood pressure. The average and SD of the box are unknown.

**Null hypothesis:** The average of the box $= 120$.

13. The average of the box is less than 120.

14. $t$ (degrees of freedom $= 5$) $= -1.2$.

15. The data support the investigators’ belief. The data do not support the conclusion that the population average is lower than 120.

16. 94.21\%. Binomial $n = 5, p = 0.2, k = 0, 1, 2$. Add the three terms.

17. 8.075\%. I expect to lose $\$0$ give or take $\$35.36$.

18. Expect 80 hits with an SE of 8, and $z = -1.3$. You get 69.6, and should use the continuity correction to see that 69 is a better answer than 70.

19. (ii) is approximately 25\%. This is an “Are you awake?” question. With hundreds of throws, the distribution of the number of hits is roughly normal and centered at 20\%. Therefore on a single day the chance of “more than 20\% hits” is about 50\%. The throws are independent, so the answer is $0.5 \times 0.5 = 0.25$.

20. (ii) equal to 15.5\%. It’s the center of the interval; recall the method of construction. This is another “Are you awake?” question.

21. (ii) goes from 12.25\% to 18.75\%. The $z$ is 2.6. The SE for the percent is 1.25\%, because the distance between the center and each end of the 95\%-CI must be 2 times the SE for the percent. [See if you can find the sample size (at least to a pretty good approximation) and the number of senior citizens in the sample. Those numbers are not necessary for the problems here, but it’s
instructive to find them.]

22. 179 to 221 (180 to 220 is fine too). In 400 tosses of a fair coin you expect 200 heads give or take 10. It’s a two-sided test so the critical $z$ is 2.05.

23. 288. It’s 96% of 300.

24. 15.56%. You can draw a chart (which is pretty big; there are 90 possibilities because you remove the diagonal from a $10 \times 10$ grid). Or you can find the chances of SS, TT, II separately and add up.

25. 30%. The easiest way is to reason by symmetry, as you do for “What’s the chance that the second card dealt from a standard deck is an ace?” Or you can use the chart to see that the fraction is 27/90.

26. 33.33%. Given that a vowel gets used up on the second draw, only 9 tickets are possibilities for the first. Of these, 3 are T’s.

27. (ii)

28. (iii). The distribution of the sample is clearly non-normal.

29. (iii). It’s the histogram of all possible sample averages and all their probabilities.

30. (ii). Compute the SE for the percent in both cases; they’re almost equal. Those are estimates based on the sample percents so the exact SEs will be slightly different, and we’ll never know what they are. But for them to differ by a factor of 2, something hugely unlikely has to have happened: namely that two very similar random samples have come out of two hugely different populations. Don’t bet on it. By the way, the square root law works on sample sizes, not population sizes.

31. −1.65% to 5.65%. The difference is estimated as 2% give or take the SE for the difference which is 2.21%. Note: differences can be negative, so there’s no problem with the use of the normal curve even though the SE is bigger than the expected value.

32. 37.5%. It’s 3/8. Either use binomial $n = 3, p = 0.5, k = 1$; or work out the chances of BGG, GBG, GGB and add up.

33. 98.62. It’s (3/8) $\times$ 263.

34. $\chi^2$ (d.f.=3) is 2.78. The null hypothesis is that gender is like the result of tossing a coin. The previous two problems showed you how to find the expected count in the category “1 boy”. Just change the value of $k$ for the other categories.

35. Between 30% and 50%.

36. The data support the investigator’s belief.

37. Roughly normal, center 20%, spread 1.96% (with the correction factor).

38. 64% (or 63.9984% if you are careful about the non-replacement). It’s the chance of “the first one is not a freshman, and the second one is not a freshman.”

39. 32% (or 32.0032%, as above).

40. There are three bars, centered 0, 1, and 2. The areas of the bars are respectively 64%, 32%, and 4%.