Answers:

1. $137/143$
2. 17
3. 17
4. $25/216$
5. 23
6. 5
7. $10/3$
8. $3/10$ or 0.3
9. $41/63$
10. 97.35%
11. mean, range, IQR
12. $49/4$ or 12.25
13. mean
14. $125/1296$
15. $3/8$
16. $2/3$
17. −2
18. no
19. $274/5525$
20. 1.65
21. Type II error
22. $3/5$
23. D
24. 7
25. $1/40$

Solutions:

1. $1-P(\text{all girls})=1-\dfrac{\binom{9}{5}}{\binom{15}{5}}=1-\dfrac{126}{3003}=\dfrac{2877}{3003}=\dfrac{137}{143}$
2. $\text{IQR}=Q3-Q1=42-25=17$
3. 80th percentile is 16th number out of 20, which is 17
4. Dice could be 1,5,6 (6 combinations); 2,4,6 (6 combinations); 2,5,5 (3 combinations); 3,3,6 (3 combinations); 3,4,5 (6 combinations); and 4,4,4 (1 combination); for a total of 25 combinations. There are a total of $6^3=216$ different rolls, so the probability is $25/216$
5. $10(0.3)+20(0.3)+30(0.2)+40(0.2)=3+6+6+8=23$
6. $\dfrac{1}{6}=\dfrac{\binom{x}{2}}{\binom{9}{2}}=\dfrac{x(x-1)}{9\cdot 8}\Rightarrow x(x-1)=12\Rightarrow x=4,$ so there are 5 black marbles
7. $2.5\cdot\dfrac{20}{\sqrt{225}}=\dfrac{50}{15}=\dfrac{10}{3}$
8. $P(B)=3P(A),\ P(C)=2P(B),\ P(A)+P(B)+P(C)=1$

   $P(A)+3P(A)+6P(A)=1\Rightarrow 10P(A)=1\Rightarrow P(A)=1/10$

   Therefore, $P(B)=3/10$.
9. $\dfrac{\binom{6}{1}+\binom{6}{2}+\binom{6}{3}}{2^6-1}=\dfrac{6+15+20}{63}=\dfrac{41}{63}$
10. From -2 to 0 s.d.s is 47.5%, and from 0 to 3 s.d.s is 49.85%, so the total is $47.5\%+49.85\%=97.35\%$
11. five-number summary is minimum, Q1, median, Q3, maximum, so the ones that are not included are mean, range, and IQR
12. $1\cdot\dfrac{1}{36}+2\cdot\dfrac{2}{36}+3\cdot\dfrac{2}{36}+4\cdot\dfrac{3}{36}+5\cdot\dfrac{2}{36}+6\cdot\dfrac{4}{36}+8\cdot\dfrac{2}{36}+9\cdot\dfrac{1}{36}+10\cdot\dfrac{2}{36}+12\cdot\dfrac{4}{36}+15\cdot\dfrac{2}{36}$
    $+16\cdot\dfrac{1}{36}+18\cdot\dfrac{2}{36}+20\cdot\dfrac{2}{36}+24\cdot\dfrac{2}{36}+25\cdot\dfrac{1}{36}+30\cdot\dfrac{2}{36}+36\cdot\dfrac{1}{36}=\dfrac{441}{36}=\dfrac{49}{4}$
13. The mean is greater because it is less resistant and will be pulled to the right by the data.
14. $\dfrac{5}{6}\cdot\dfrac{5}{6}\cdot\dfrac{5}{6}\cdot\dfrac{1}{6}=\dfrac{125}{1296}$

15. $P(\text{2 boys, 2 girls in middle}) = \dfrac{\binom{4}{2}}{2^4} = \dfrac{6}{16} = \dfrac{3}{8}$

16. Winning sequences for the first person would be T or HHT or HHHHT, etc. (an even number of heads followed by a tails). The probabilities are $\left(\frac{1}{2}\right)^1, \left(\frac{1}{2}\right)^3, \left(\frac{1}{2}\right)^5$, etc., so the probability would be $\frac{1}{2} + \frac{1}{8} + \frac{1}{32} + \ldots = \dfrac{\frac{1}{2}}{1 - \frac{1}{4}} = \dfrac{\frac{1}{2}}{\frac{3}{4}} = \dfrac{2}{3}$

17. $\text{residual} = \text{observed} - \text{expected} = 95 - 97 = -2$

18. no, don't reject because the p-value must be compared to $\frac{\alpha}{6} = .00833$, so $p > \frac{\alpha}{6}$

19. First, choose the suit (4), then choose the number of total flushes, which is $\binom{13}{3}$, then subtract the number of straights, which is 4 suits times 12 possible beginning cards (all cards except King). Therefore, the probability is:
$$\frac{\binom{4}{1}\cdot\binom{13}{3} - \binom{4}{1}\cdot 12}{\binom{52}{3}} = \frac{4\cdot 286 - 4\cdot 12}{22100} = \frac{274}{5525}$$

20. The middle 90% is between $z = -1.645$ and $z = 1.645$, so to the nearest hundredth, the absolute value is 1.65.

21. You rejected the null hypothesis when the alternative hypothesis was true. This is a correct decision.

22. $$P(\text{lasts 150 hours} | \text{lasts 100 hours}) = \frac{P(\text{lasts 150 hours} \cap \text{lasts 100 hours})}{P(\text{lasts 100 hours})}$$
$$= \frac{P(\text{lasts 150 hours})}{P(\text{lasts 100 hours})} = \frac{\frac{1}{5}}{\frac{1}{3}} = \frac{3}{5}$$

23. If all data are the same, A is true. If data consist of 3 equally spaced numbers and the middle one is small with the others spread out a lot, B could be true. If all the bottom fourth of the data are equal and the top fourth of the data are equal, C could be true. Therefore, all are possible (D).

24. $P(X \geq 2) \geq 0.5 \Rightarrow 1 - P(X = 0) - P(X = 1) \geq 0.5 \Rightarrow P(X = 0) + P(X = 1) \leq 0.5$
$\left(\frac{3}{4}\right)^n + \binom{n}{1}\left(\frac{1}{4}\right)\left(\frac{3}{4}\right)^{n-1} \leq 0.5 \Rightarrow \left(\frac{3}{4}\right)^{n-1}\left(\frac{3+n}{4}\right) \leq 0.5$. Inspection shows the first value of n that works is $n = 7$.

25. 74 is 2 standard deviations above the mean, so that region constitutes 2.5% of the total area. As a fraction, this is $\frac{1}{40}$.