1. (a) False: a t-distribution has less density near 0, more in its tails.
(b) False: \( P(A|B) = P(A) \). (c) True.
(d) False: \( A \cap B = \{7\} \). (e) True.
(f) False: The probability that the null hypothesis is true is either 0 or 1. The meaning of the p-value is different, even though the p-value is indeed a probability.

2. (a) (6 pts) The x values should be somewhat centered around 20, and most points between 10 and 30.
(b) (6 pts) The last deviation has to be +5 in order for all deviations to cancel out (sum up to 0). Then \( s = 5.83 \text{ psi} \).

3. (10 pts) \( p = \frac{7}{20} \times 0.30 + \frac{13}{20} \times 0.45 = 0.3975 \).

4. (a) (4 pts) \( H_0: \mu = 6.4 \text{ cm} \) and \( H_A: \mu \neq 6.4 \text{ cm} \), where \( \mu \) is the average bill length in the population of all captive Humboldt penguins (in zoos).
(b) (12 pts) \( t = \frac{6.1 - 6.4}{1.2/\sqrt{19}} = 1.09 \), on 18 df. The p-value is > 2 * 0.10 and we fail to reject the null hypothesis. Conclusion: there is no evidence that captive Humboldt penguins have a bill length any different from wild penguins (6.4 cm).

5. (16 pts) Consider \( H_0: p = 0.32 \) vs the two-sided alternative \( H_A: p \neq 0.32 \), where \( p \) is the germination rate of oriental bittersweet seeds in tulip poplar stands. The number of seeds that germinate, out of 120 seeds, has a binomial \( B(120, 0.32) \) distribution if the null hypothesis is true, which is approximated by a normal \( \mathcal{N}(38.4, 5.11^2) \) distribution (\( np = 38.4 \) and \( nq = 81.6 \) are both > 5). We observe \( z = (58 - 38.4)/5.11 = 3.835 \) (or \( X^2 = 14.71 \) with a chi-square test) so that the p-value is \( p = 2 \times 0.00006 = 0.0001 \). There is very strong evidence that the germination rate in tulip poplar stands is greater than 0.32.

6. (a) (6 pts) Binomial \( B(10, 0.72) \), skewed left.
(b) (5 pts) 0.180
(c) (5 pts) 0.18 + 0.18 - 0.18 * 0.18 = 0.327 because the two events are not mutually exclusive. We can calculate the probability of finding oriental bittersweet in exactly 6 plots out of 10 in both locations (0.18 * 0.18) because these events are independent.
(d) (10 pts) We may argue for a one-sided test, \( H_A: p_r < 0.72 \) because of the scientist’s suspicion. We are not told, but this suspicion could be based upon prior data. \( H_0: p_r = 0.72 \). The number of plots where oriental bittersweet is present has a binomial distribution \( X_r \sim B(10, 0.32) \) if the null hypothesis is true, with an expected value of 3.2. The values that are as extreme as or more extreme than what was observed are \( x = 0 \) and \( x = 1 \), so the p-value is \( P(X_r = 0) + P(X_r = 1) \). Using the binomial formula, we get \( .000003 + .000076 = 8.10^{-5} \). (we could double this by two for a two-sided test). There is very strong evidence that \( p_r < 0.32 \).