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Each problem is worth 10 points. Open book and notes.
Questions 1 to 5 refer to this scenario: An ESP experiment is done in which a participant guesses which of 4 cards the researcher has randomly picked, where each card is equally likely. This is repeated for 220 trials and the participant guesses correctly 72 times. The null hypothesis is that the subject is guessing, while the alternative is that the subject has ESP and can guess at higher than the chance rate.

1. State the null and alternative hypotheses in symbols.
2. Calculate the value of the test statistic.
3. Find the p-value for the test. Draw a sketch of the appropriate distribution showing this value.
4. Make a conclusion and state it in the context of the problem.
5. Explain what a Type 1 error would be in this situation.

Questions 6 to 10 refer to this scenario: A study was done to see if listening to Mozart would help increase IQ in the short-term, compared to listening to a relaxation tape. (Honest! The data presented here are simplified, but reflect what was found.) Participants came to the laboratory and listened to a relaxation tape for half an hour one week and Mozart for half an hour a different week. (The order was randomized for each participant to rule out learning effects.) The difference in score on an IQ test for the two conditions was computed for each participant, with a positive difference meaning that the IQ was higher after listening to Mozart. The mean of the differences was 4.3 points and the standard deviation of the differences was 5.8 points. There were 10 participants.
6. State the null and alternative hypotheses in symbols. Be sure to use the correct symbols.
7. Calculate the value of the test statistic.
8. Draw a sketch of the appropriate distribution showing the $p$-value and find the $p$-value range for the test. (You can't find an exact $p$-value with the tables you have available.)
9. Make a conclusion and state it in the context of the problem.
10. Explain what a Type 2 error would be in this situation.

