1. (17 pts) The National Cancer Institute conducted a randomized, double-blind experiment to compare two drugs: tamoxifen (T) and raloxifene (R), for preventing various types of cancer. The researchers found that 36 of 4732 women in the T group developed uterine cancer, compared to 23 of 4712 women in the R group. These data are summarized in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Tamoxifen</th>
<th>Raloxifene</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed uterine cancer</td>
<td>36</td>
<td>23</td>
<td>59</td>
</tr>
<tr>
<td>Did not develop uterine cancer</td>
<td>4696</td>
<td>4689</td>
<td>9385</td>
</tr>
<tr>
<td>Total</td>
<td>4732</td>
<td>4712</td>
<td>9444</td>
</tr>
</tbody>
</table>

a) (2 pts) Explain what double-blindness means in this study.

b) (1 pt) Identify the response variable in this study.

c) (2 pts) Calculate the $z$-test statistic for testing whether these data provide strong evidence that the two drugs differ with regard to the development of uterine cancer.

d) (2 pts) Based on the value of this test statistic, do you suspect that the difference between the groups is statistically significant at the .05 significance level? Explain briefly, but do not calculate the p-value.

e) (2 pts) Describe what type II error would mean in this context.

f) (1 pt) Calculate the relative risk of developing uterine cancer between the T group and the R group.

g) (3 pts) Determine a 95% confidence interval for the population relative risk.

h) (2 pts) Interpret what this confidence interval says (i.e., you’re 99% confident of what?).

i) (1 pt) If the study had involved fewer people, how would the confidence interval have changed? (Circle your answer; do not bother to explain.)

   Narrower         Same width         Wider

j) (1 pt) If you had used a 90% confidence level, how would the confidence interval have changed? (Circle your answer; do not bother to explain or calculate.)

   Narrower         Same width         Wider

2. (11 pts) A national survey conducted on October 1-5, 2009 asked pet owners whether they would perform CPR on their pet in the event of a medical emergency. The survey found that 63% of dog owners and 53% of cat owners responded that would perform CPR on their pet.

a) (2 pts) Could this study have used random sampling or random assignment? Choose the appropriate one of these, and briefly explain.
b) (2 pts) Are .63 and .53 parameters or statistics? Also state appropriate symbols to use for these values.

c) (2 pts) State (in symbols only) the appropriate hypotheses for testing whether dog owners and cat owners differ with regard to willingness to perform CPR on their pets.

d) (2 pts) What further information about the survey results do you need in order to carry out a test of these hypotheses?

e) (3 pts) A 95% confidence interval turns out to be: (-0.161, -0.039). Explain what this interval says, being sure to make clear what the parameter being estimated is.

3. (12 pts) Professional baseball teams have one coach at first base and one coach at third base, with third base regarded as the more important and prestigious position. An article in the August 11, 2010 New York Times raised a concern that minority coaches are under-represented at third base compared to first base. The article cited the following data:

- 27 of 60 base coaches in Major League Baseball (MLB) are members of minority groups
- 7 of the 30 third-base coaches in are members of minority groups.
- 20 of the 30 first-base coaches in are members of minority groups.

a) (2 pts) Is this an observational study or an experiment? Explain briefly.

b) (5 pts) Indicate how to set up the calculation of the p-value for investigating the article’s suspicion from these data. Express your answer as \( P(X \leq k) \), where you indicate the appropriate value of \( k \), use an appropriate symbol where the ____ is, and also specify the probability distribution of \( X \), including any values of the distribution are relevant to the p-value calculation.

c) (3 pts) The p-value turns out to equal .0008 (to four decimal places). Explain (in detail) what this p-value is the probability of, as if to someone interested in the New York Times article who has not taken a statistics class.

d) (2 pts) Summarize the conclusion that you would draw from the p-value.

4. (4 pts) An article titled “Which Dogs Bite?” appeared in the June 1994 issue of the journal Pediatrics. The researchers examined all reports of biting dogs to the Denver Municipal Animal Shelter in 1991. They then contacted as many owners of those dogs as they could reach, asking them a series of questions about the dog and about how they care for the dog. They also contacted a sample of owners of dogs who had not bitten anyone, and they asked these dog owners the same series of questions. Their goal was to identify characteristics of the dogs or their handling that are related to biting behavior.

a) (1 pt) What type of study is this? (Circle your answer; do not bother to explain.)

Cohort, Case-control, Cross-classified
b) (3 pts) Would you advise these researchers to be concerned about confounding variables with this study, or is that not an issue? Explain briefly. (You do not need to provide an example of a confounding variable.)

5. (6 pts) Three questions are given below. Circle the letters EXP next to any question that can reasonably be investigated with a randomized experiment. Also circle the letters CAT for any question that has a response variable that is categorical.

- Does using an underhand shooting method for a free throw in basketball increase the probability of successfully making the shot, as opposed to using the conventional overhand shooting method? EXP? CAT?

- Is the proportion of teenagers in England who have read at least one *Harry Potter* book greater than the proportion of teenagers in the U.S. who have read at least one *Harry Potter* book? EXP? CAT?

- Do cows tend to produce more milk, on average, if their handlers give them a name and speak to them using that name? EXP? CAT?