Name: ____________________________

Directions: **Work only on this sheet** (on both sides, if needed). MAKE SURE TO COPY YOUR ANSWERS TO A SEPARATE SHEET FOR SENDING ME AN ELECTRONIC COPY LATER.

Important note: Remember that in problems calling for R code, you are allowed to use any built-in R function, e.g. **choose()**, **sum()**, etc.

1. The following R function forms a confidence interval for a population proportion, based on the sample in the vector **x**, of approximate confidence level **conflevel**.

```
pci <- function(x,conflevel) {
       n <- __________(x)  # blank (a)
       p_hat <- __________(x)  # blank (b)
       stderr <- __________   # blank (c)
       multiplier <- _________   # blank (d)
       # in R, last value computed is returned
       c(__________)  # blank (e)
}
```

For instance, if our sample data is 1, 0, 0, and 1, and we want an approximate 95% confidence level, the call would be

```
pci(c(1,0,0,1), 0.95)
```

(a) (10) Fill in blank (a).

(b) (10) Fill in blank (b).

(c) (10) Fill in blank (c).

(d) (10) Fill in blank (d).

(e) (10) Fill in blank (e).

2. There is the concept of the *power* of a hypothesis test, defined to be the probability of rejecting H_0 in a circumstance in which H_0 is false. For instance, consider the coin example in pp.221ff. The power of the test at 0.55 is defined to be the probability that we reject H_0 if the true value of p is 0.55.

(a) (15) Power plays a big role in theoretical statistics, where theorems are proved for things such as Uniformly Most Powerful tests. But in practice, we may wish the power to be low, not high, in some settings. Fill in the blank: In the coin problem, for example, we may wish to have low power in the setting in which p __________________________.

(b) (10) Consider the light bulb lifetime problem in pp.226-227. Find the power of the test for the case $\mu = 1250$.

3. (15) Suppose we have two population values to estimate, ω and γ, and that we are also interested in the quantity $\omega + 2\gamma$. We'll estimate the latter with $\hat{\omega} + 2\hat{\gamma}$. Suppose the standard errors of $\hat{\omega}$ and $\hat{\gamma}$ turn out to be 3.2 and 8.8, respectively. Find the standard error of $\hat{\omega} + 2\hat{\gamma}$.

4. (10) A news report tells us that in a poll, 54% of those polled supported Candidate A, with a 2.2% margin of error. Assuming that a 95% level of confidence was used, find the approximate number polled.

Solutions:

1.a-e

```
pci <- function(x,conflevel) {
       n <- length(x)
       p_hat <- mean(x)
       stderr <- sqrt(phat * (1-phat) / n)
       multiplier <- qnorm(0.5 + conflevel / 2)
       # in R, last value computed is returned
       c(phat - multiplier*stderr, phat + multiplier*stderr)
}
```

2.a is near 0.5

2.b

```
1 - pgamma(15705.22,10,1/1250)
```

3.

$$\sqrt{1^2 \cdot 3.2^2 + 2^2 \cdot 8.8^2}$$

4.

```
0.54 * 0.46 / (0.022/1.96)^2
```