Q1 a. The student is randomly guess and doesn't have psychic power. It means the probability of guessing correctly on a trail and correctly by chance are same. Null Hypothesis (H0): p=0.5 Student have psychic power and does better than randomly guessing. Probability of guessing correctly is greater than guessing correct by chance. Alternative Hypothesis (H1): $p > 0.5$ b. In light of the null hypothesis, the number of accurate guesses (Y) out of 20 trials will follow a binomial distribution with parameters if the student guesses at random (no psychic ability). = 20, where n (trials) = 20, p=0.5 (single trial success probability). Statement i is correct. The reason for this is that, assuming the null hypothesis is true, we are attempting to determine the probability of receiving a result that is either as extreme or more severe than the observed result (13 right predictions out of 20). c.

```r
pvalue<-1 - pbinom(12, 20, 0.5)
pvalue
```

```
## [1] 0.131588
```

The P-value for the student guessing 13 right out of 20 can be calculated using the binomial distribution with parameters n=20 and p=0.5. This P-value represents the probability of getting a result as extreme as or more extreme than 13 correct guesses assuming the null hypothesis is true. The P-value for 13 correct out of 20 is 0.131588. It's not extremely low, so it doesn't provide strong evidence against the null hypothesis. d.

```r
1 - pbinom(19, 20, 0.5)
```

```
## [1] 9.536743e-07
```

For a student to guess 19 out of 20 correctly, the P-value can be calculated using the binomial distribution with n=20 and p=0.5. The P-value for 19 correct out of 20 is extremely low. This would be considered strong evidence against the null hypothesis and could be seen as intriguing evidence favoring the alternative hypothesis that the student might have psychic powers. 2. a. The expected number of right answers, assuming that students were guessing at random, may be calculated by multiplying the total number of questions (720) by the likelihood that each question will be correctly answered (0.25, given four answer alternatives by random guessing), so the expected value would be $720 \times 0.25 = 180$.

b. The probability of getting 237 or more correct answers out of 720, assuming random guessing, can be calculated as follows:

```r
p_value <- 1 - pbinom(236, 720, 0.25)
p_value
```

```
## [1] 1.157004e-06
```

Therefore, 1 - pbinom(236, 720, 0.25) is the correct one-tailed significance probability.

c. "The significance probability is very small. This means a number of correct answers this high would be very surprising if the students were just randomly guessing. The data is thus highly incompatible with the null hypothesis. We have strong evidence in favor of the alternative hypothesis that students are doing better than random guessing."

3.

(a) Rolling a Six-Sided Die: Null Hypothesis (H0): p=1/6 (probability of getting a six) Alternative Hypothesis (H1): p<1/6 Number of successes: 15 sixes in 100 rolls

```r
pbinom(15, 100, 1/6)
```

```
## [1] 0.3876576
```

b) Blackjack Scenario: Null Hypothesis (H0): p=32/663 (probability of getting 21 with two cards) Alternative Hypothesis (H1): p<32/663 Number of successes: 59 twenty-ones in 1,000 trials P-value calculation:

```r
pbinom(59, 1000, 32/663)
```

```
## [1] 0.9477338
```

c.

```r
left_pvalue <- pbinom(1150,2215,0.5)
right_pvalue <- 1-pbinom(1149,2215,0.5)
min(left_pvalue,right_pvalue)*2
```

```
## [1] 0.07426804
```

thus pvalue=0.0742

d.

```r
1 - pbinom(236, 720, 0.25)
```

```
## [1] 1.157004e-06
```

5. a

```r
xbar <- 6.5
s <- 12
n <- 61
c(xbar, s, n)
```

```
## [1]  6.5 12.0 61.0
```

```r
t.stat <- (xbar - 0) / (s / sqrt(n))
t.stat
```

```
## [1] 4.230552
```

```r
1-pt(t.stat, df = n - 1)
```

```
## [1] 4.04772e-05
```

```r
a <- qt(.975, df = n-1)
a
```

```
## [1] 2.000298
```

```r
xbar - a * s / sqrt(n)
```

```
## [1] 3.426657
```

```r
xbar + a * s / sqrt(n)
```

```
## [1] 9.573343
```