R Questions

Answers are included as comments in R script. Please review there for completeness. Included here for convenience.

1.b - t-test mu=2

There is insufficient evidence to support rejecting the null hypothesis that the population mean is equal to 2 (t-test, p-val = 0.14). We estimate the mean to be 1.497, with a 95% confidence interval of (0.79, 2.2).

1.d - conceptual

The p-value differs because the approximation to the Normal distribution underestimates the likelihood of large, extreme values. This is due to the small sample size and the approximation of the population standard deviation as the sample standard deviation.

The t-distribution is more appropriate for real life examples, where the population sigma is unknown, so long as sample sizes are reasonably large.

2.d - replicate() 10k

a_prop = 0.9342 < e_prop = 0.964

In this case, the result from exact is within the confidence interval over 96% of the time, while the approx result is less than 94% of the time.

2.e - replicate() 100

With fewer replications, the results are further apart:

exact: 0.98

approx: 0.92

Conceptual Questions

3. Ridley's sea turtle

1983:1989 – 16m, 10f

a. Male-biased? Need a one-sided exact test to determine if $\hat{\pi}$ supports rejecting the null hypothesis that proportions were equal.

$\hat{\pi} = 16/26 = 0.615$

$\pi_0 = 0.5$

H_0: $\pi = \pi_0$
H_A: $\pi \geq \pi_0$

From R:

```
> E <- binom.test(x=16,n=26,p=0.5,conf.level = 0.95,al
ternative = "g")
> E

        Exact binomial test

data:  16 and 26
number of successes = 16, number of trials = 26, p-val
ue
= 0.1635
alternative hypothesis: true probability of success is
greater than 0.5
95 percent confidence interval:
 0.4356627 1.0000000
sample estimates:
probability of success
             0.6153846
```

There were 16 males in a population of 26 turtles. There is insufficient evidence that the true proportion of male turtles is not 0.5, and hence we can't reject the null hypothesis (exact Binomial test, p = 0.1635). The true proportion of males is estimated to be 0.615, and with 95% confidence the true proportion is in the range (0.436, 1)

1990:2001 – 19m, 56f

b. female-biased? Need a one-sided exact test to determine if $\hat{\pi}$ supports rejecting the null hypothesis that proportions were equal.

$\hat{\pi} = 56/75 = 0.747$

$\pi_0 = 0.5$

H_0: $\pi = \pi_0$
H_A: $\pi \geq \pi_0$

From R:

```
> E <- binom.test(x=56,n=(19+56),p=0.5,conf.level = 0.
95,alternative = "g")
> E

        Exact binomial test

data:  56 and (19 + 56)
```

```
number of successes = 56, number of trials = 75, p-val
ue
= 1.121e-05
alternative hypothesis: true probability of success is
greater than 0.5
95 percent confidence interval:
 0.6508107 1.0000000
sample estimates:
probability of success
             0.7466667
```

There were 19 females in a population of 75 turtles. The data is inconsistent with the null hypothesis of a female proportion of 0.5, and hence we reject the null hypothesis (exact Binomial test, p = 1.121e-5). The true proportion of females is estimated to be 0.747, and with 95% confidence the true proportion is in the range (0.651, 1)

4. Average systolic blood pressure of a normal male: 129

n = 12

$\mu_0 = 129$

H_0: $\mu = \mu_0$
H_A: $\mu \geq \mu_0$

bp <- c(115, 134, 131, 143, 130, 154, 119, 137, 155, 130, 110, 138)

Student's t-distribution

df = 11

From R:

bp <- c(115, 134, 131, 143, 130, 154, 119, 137, 155, 130, 110, 138)

t.test(bp,mu=129,conf.level = 0.95, alternative = "g")

```
     One Sample t-test

data:  bp
t = 0.9939, df = 11, p-value = 0.1708
alternative hypothesis: true mean is greater than 129
95 percent confidence interval:
 125.7724      Inf
sample estimates:
mean of x
      133
```

Measurements of systolic blood pressure from 12 adult males were used to understand if their community's dietary habits might contribute to high blood pressure. The evidence is insufficiently strong to support rejecting the null hypothesis of a population mean systolic blood pressure of 129, and hence we can't reject the null hypothesis (one sample t-test, $p = 0.1708$). The mean blood pressure is 133, and with 95% confidence the true mean is in the range $(125.7, \infty)$