Problem 2

Sample Mean: 114.4133

Standard Deviation: 685.067

Number of Samples: 365

Alpha Value: 0.05

T Value: 1.966503

Error: 70.51494

CI Lower (95%): 43.89838

CI Upper (95%): 184.9283

Summary: The figure, particularly the scatter plot, very clearly shows the early September flood event's extremity compared to Houston's historical streamflows over the past year. The histogram also (barely) shows these extreme values. Of note the histogram contains 100 bins because, at lesser bin values, the higher values were nearly invisible and the bins showed almost no curve structure. With the current number of bins there is at least some semblance of structure.

Also of note is the seemingly enormous confidence intervals around the sample mean, with an error of 70 cfs. This seems huge until the gargantuan "1000-year flood event" flows are taken into account, at which point this error seems more reasonable. In traditional statistics this may even lead analyses to treat the flood event as an outlier, but we know better than that…

Problem 3

T-test output:

Welch Two Sample t-test

data: usgsdown.disch$flow_cfs[!is.na(usgsdown.disch$flow_cfs)] and usgsup.disch$flow_cfs[!is.na(usgsup.disch$flow_cfs)]

t = 1.4188, df = 440.09, p-value = 0.1567

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-63.39022 392.51170

sample estimates:

mean of x mean of y

278.9741 114.4133

Summary: This t-test was written using a null hypothesis stating that the means of the two samples is equal to zero, and therefore the two samples are identical. Seeing as the p-value of this analysis is 0.1567, p is definitely larger than the common alpha of 0.05 (or even 0.10), meaning that the null hypothesis is rejected. This means that these two samples are definitely statistically different (or, more properly, the difference between both sample means is not equal to 0).

Hydrology-wise these stream are on the same reach, so the downstream gage should be seeing more streamflow (in a natural system). I actually ran a one-tailed "greater than" t-test to check this, and the resultant p-value was around 0.07, which was not as conclusive as I would have liked… but I still believe the assumption that downstream gages contain more flow is generally valid. Another reason the flows may be different is if there were a tributary entering the analyzed reach between both gaging stations; this again would increase the flows of the downstream gage when compared to the upstream gage. Lastly, to play Devil's advocate, a huge *consumption* (notice I did *not* say withdrawal) of water between the gages could make the upstream flows *larger* than the downstream flows. Withdrawals could do the same thing as well, assuming the water was withdrawn between the two gages before being returned downstream of both gages.