**Tripos, Part 2A, Paper 3**
**Supervision 1**

1. Fifteen male economists are in a life raft with a maximum carrying capacity of 2850 pounds. If the distribution of weights of male economists is normal with a mean of 178 pounds and with a standard deviation of 17 pounds, find

a) the probability that all the economists weigh less than 189 pounds

b) the probability that the raft is overloaded and will sink

c) the maximum number of economists that should enter the raft if the probability of overloading is not to exceed 0.0001

2. The STATA file Wagefull.dta contains data on hourly wages and other variables for 3296 working individuals.

a) Draw a histogram of wages for the whole population.[1] What kind of distribution do you find? Do the same exercise for the *logarithm* of wages. How do the two histograms compare? Why is that the case? (Hint: think about what the function $y = \ln(x)$ looks like)

b) Use these data to calculate mean and standard deviation of the logarithm of wages for males.

c) What is the standard deviation of *the mean* of log-wage for males? How does it compare with the standard deviation of log-wage for males?

d) State clearly the sampling distribution of the estimated mean, and test the hypothesis that the mean of log wages for males is equal to 1.7 versus not 1.7. Under what assumption does this sampling distribution hold?

e) Explain how you would conduct a test of the hypothesis that the mean of log wages is the same for males and females, stating the sampling distribution of the relevant statistic, and conduct such a test.

f) (Harder) Is the hypothesis of question (d) the same as the hypothesis that men and women have the same wage on average?

3.

a) Now, use the same data to calculate estimates of the variance of the logarithm of wages for females (note that the table will give the standard deviation rather than variance).

b) State clearly the sampling distribution of the estimated variance.

c) Explain how you would conduct a test of the hypothesis that the variance of log wages is the same for males and females, stating the sampling distribution of the relevant statistic, and conduct such a test.

d) What would be your intuition about which variance should be larger? Why? Is that what the data bear out?

[1] The relevant command for drawing a histogram for variable x in STATA is "hist x, bin(25)", where bin says how many bins you wish to see in the histogram; you can play a bit with the "bin" option.