

Stat 431/511 Midterm, Summer 2004

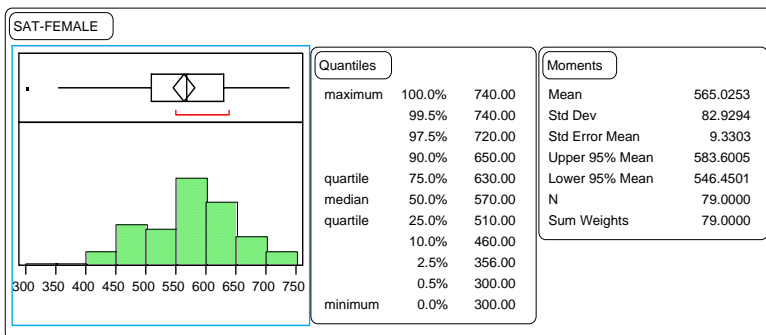
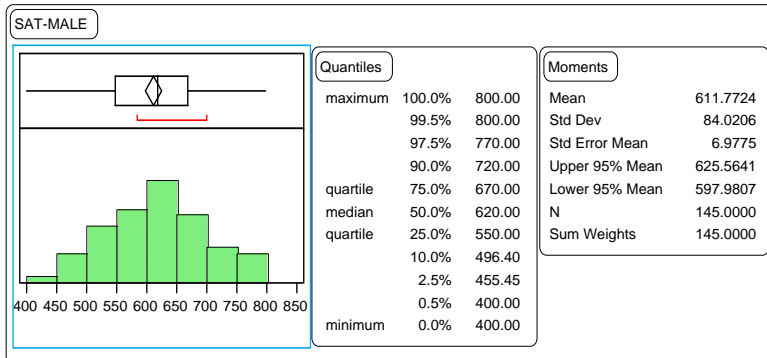
July 19, 2004

Time: 90 minutes

Instructions:

1. The midterm is closed book. Up to 3 pages one-sided A4 sized cheat sheets are allowed. Normal table and t -table are provided.
2. You may use a calculator.
3. Show your work and partial credits will be given.
4. You must write the exam using pen (not pencil).
5. When performing hypothesis tests, clearly state the null and alternative hypothesis and show the critical value and/or P-value (from the table) when appropriate.

2 (10 pts.) Is there a difference between the average SAT scores of males and females? The CSDATA data set summarized below gives the math scores for a group of 224 computer science majors.



For a) and b), assume that $\sigma_1 = \sigma_2 = \sigma$.

- a) Is the data significant at $\alpha = .05$ level to show that the mean SAT score of males is different from that of females? Set up appropriate hypotheses and carry out the test.

- b) Is the data significant at $\alpha = .01$ to show that the mean SAT score of female students is at least 10 points lower than the mean score for male students? Again set up the hypotheses and carry out the test.
- c) We are also interested in the overall mean SAT scores. Find a 95% confidence interval for the overall mean SAT scores.
- 1) Derive a formula first.
 - 2) Calculate the interval.
- d) Also carry out a test that the overall mean SAT score for this year is **higher** than **594** which was reported for the previous year. Use $\alpha = .05$. You need to proceed as following: 1) Set up the hypotheses. 2) Give the testing statistic and explain why. 3) Carry out the test.

4 (5 pts) Suppose that X follows a $\text{Bin}(100, p)$ distribution. Consider the hypotheses:

$$H_0: p=.5 \text{ v.s. } H_a: p \neq .5$$

Answer the following questions using the normal approximation to the binomial distribution.

a) Consider the test that rejects H_0 if $|\mathbf{X}-50| > \mathbf{k}$. Find the value of \mathbf{k} so that the type I error of the test is **.05**.

b) Consider the test that rejects H_0 if $|\mathbf{X}-50| > \mathbf{2}$. Calculate its type II error when $\mathbf{p}=\mathbf{.55}$.