

NAME _____

21 November 2008

MATH 156.6 — TEST III

PLEASE READ THESE INSTRUCTIONS:

Problems have varying point values, which are specified next to each problem number. Move quickly through the test, but try to be as accurate as you can. Do as many problems as you like; points over 100 will count as extra credit.

You may use a graphing/statistical calculator. You may not use your book or notes or a formula card.

If you want credit for an answer, *you must explain what you are doing – this means:*

- **define every variable/symbol you use;**
 - **explain/motivate each step of your work;**
 - **when you use a theorem/named formula/example/method from class or the book, refer to it by name;**
- and ⇒ **explain what you entered into the calculator and what it was doing, every time you copy a number from the calculator screen to your test paper.**

PLEASE TURN OFF YOUR CELL PHONE.

[Please do not write in the boxes below:]

1 :	/10
2a :	/10
2b :	/15
2c :	/15
2d :	/10
3a :	/15
3b :	/10
3c :	/15
4a :	/10
4b :	/15
5a :	/10
5b :	/15
Σ :	/150

- [10] **1** The amount households pay for Internet access per month varies a lot – in a way which is not particularly Normal [in fact, it is rather skewed] – but across the US the average is \$38 and the standard deviation is \$10. If we take an SRS of 500 households and find out how much they pay for 'net access, what will be the probability that the sample mean will be more than \$39? Explain completely!

- 2** Here is data, oddly enough, on the rates at which 18 randomly chosen wounded newts' skin heals (in micrometers per hour, $\mu m/hr$):

29	27	34	40	22	28	14	35	26
35	12	30	23	18	11	22	23	33

- [10] **(a)** Make a relevant graph of this data, and discuss issues of data quality regarding whether you would be comfortable using it to construct a confidence interval.

- [15] **(b)** Suppose that somehow you know the standard deviation of the wound healing rate for the entire world population of this species of newts is $\sigma = 8\mu m/hr$. Compute a 90% confidence interval for the mean healing rate for this species.
- [15] **(c)** Explain clearly and succinctly but completely what it means that that was a “90% confidence interval”.
- [10] **(d)** How large a sample of newts would you have to examine in order to have an estimate of the mean wound healing rate with a margin of error of $1\mu m/hr$ and still 90% confidence?

3

Suppose that SAT math scores usually have mean 475 and standard deviation 100. Suppose also that coaching may change the scores themselves but not their standard deviation. Let's do some hypothesis testing with the impact of SAT coaching....

- [15] (a) *JP's Math Tutoring Service (JP's MTS)* coaches 1000 students but *JP's* records show that these students have an average of only 478. If an aggressive prosecutor goes after *JP* in court for false advertising when he says "You'll do better than the national average if you study with us", can *JP* prove his advertisement is statistically justified by his data?
- [10] (b) *JP* decides to write a book, *JP's Math SAT Tips and Tricks (JP's T&T)*. It actually sells very well, and 10,000 students buy and use it – *JP* has a friend at the Education Testing Service who is able to extract the information that those 10,000 students scored an average of $\bar{X} = 478$ (still!). Can *JP* put that same advertisement he used at *JP's MTS* on the 2nd edition of *JP's T&T* without fearing the pesky prosecutor?
- [15] (c) Presumably, in parts (b) and (c) you calculated a p -value in your work. Explain why the calculated p -values lead you to make the conclusions you made, by explaining what the p -value **means**.

4

We are interested in the percentage of nitrogen in the earth's atmosphere in ancient times, so we look at bubbles in very old amber. Here are some measurements of these percentages for amber which formed in the late Cretaceous era (75 to 95 million years ago):

63.4 65.0 64.4 63.3 54.8 64.5 60.8 49.1 51.0

- [10] **(a)** Make a graph, comment on its relevant characteristics and other concerns you might have for building a CI with this data.

- [15] **(b)** Regardless of whatever you said in part **(a)**, find a 95% confidence interval for the percentage of nitrogen in Cretaceous air.

5

Now let's study wounded *frogs*, and investigate if applying an electric field changes the rate of wound healing. Here is some data for healing rates in an electrified limb compared to another, normal (non-electrified) limb – the control – of the same frog (rates always in $\mu m/hr$), for 14 test frogs:

Electrified limb	24	23	47	42	26	46	38	33	28	28	21	27	25	45
Control limb	25	13	44	45	57	42	50	36	35	38	43	31	26	48

- [10] **(a)** This is a “matched-pairs” situation, so add another relevant row to the above data table. Explain here what you are doing and why. Do you like the data quality? Why or why not?

- [15] **(b)** (Again, disregarding the data quality conclusions from part **(a)**....) Does this data support the hypothesis that electrification changes the rate of healing of wounds in this kind of frog? What is the significance level at which your conclusion is valid?