NAME_____ 20 October 2008

MATH 156.6 — TEST II

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.

If you want credit for an answer, *you* **must** *explain what you are doing – this means defining your terms and explaining* **each step** *in your work.*

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

PLEASE TURN OFF YOUR CELL PHONE.

[Please do not write in the boxes below:]

1 :	/9
2 :	/11
3 :	/10
4 :	/16
5 :	/20
6 :	/12
7 :	/24
8 :	/28
9 :	/6
10 :	/8
Σ :	

[9] **1** Subjects arrive for a study of exercise and fitness. Describe in each of the following cases an appropriate sample space:

[3] **(a)** The subject is either male or female.

[3] **(b)** You measure VO_2, the maximum volume of oxygen consumed per minute during exercise. VO_2 is generally between 2.5 and 6.1 liters per minute.

[3] **(c)** You measure the maximum heart rate (beats per minute).

[11] **2** Spam constitutes more than 75% of the e-mails on the Internet. Choosing a spam message at random, here is the distribution of topics:

Topic:	Adult	Financial	Health	Leisure	Products	Scams
Probability:	.145	.162	.073	.078	.210	.142

[5] **(a)** What is the probability that a spam e-mail does not concern one of the above-listed topics? Why?

[6] **(b)** You grandmother particularly dislikes "Adult" and "Scam" e-mails. What is the probability that a randomly chosen spam e-mail falls into one of these categories she hates? Why?

[10] **3** The simplest addition rule for probabilities, $P(A \cup B) = P(A) + P(B)$ is not always true. Give (in words) a real-world example of events A and B for which this rule is not true.

[16] **4** Students in an English class type a 250-word essay, then run a spell-checker. Here is the distribution of the RV X which is the number of spelling errors found:

Value of X:	0	1	2	3	4
Probability:	.1	.2	.3	.3	.1

[5] **(a)** Write the event "at least one error found" in terms of X.
What is the probability of this event?

[4+4+3] **(b)** Describe the event $X \leq 2$ in words.
What is its probability?
What is the probability that $X < 2$?

[20] **5** I have two normal (six-sided) and fair dice, one green and one red. I roll them independently.

[5+5] **(a)** What is the sample space of this experiment?
What are the probabilities of each of the outcomes in the sample space? Why?

[10] **(b)** Define a random variable X as the difference between the number of pips showing on the green die and the number showing on the red die. What is the distribution of X?

[12] **6** Government data show that 6% of the American population are at least 75 years of age and about 52% of Americans are women. Explain why **it is wrong to conclude** that since $.06 \cdot .52 = .0312$ about 3% of Americans are women ages 75 or over. *[Hint: it might help to think in terms of probabilities.]*

[24] **7** Ramon has applied to both Princeton and Stanford. Suppose his guidance councelor has perfect knowledge and tells him that the probability Princeton will admit him is .4, the probabilty Stanford will admit him is .5, and the probability he will be admitted by both schools is .2.

[10] **(a)** Make a Venn diagram for this situation.

[4] **(b)** What is the probability that neither university admits Ramon? Write the probability you are computing symbolically and then give the numerical value.

[4] **(c)** What is the probability that he gets into Stanford but not Princeton? Write the probability you are computing symbolically and then give the numerical value.

[6] **(d)** Are admission to Princeton and admission to Stanford independent events?

[28] **8** Leakage from underground gasoline tanks at service stations is a serious environmental hazard... but lax governmental oversight has lead to a situation in which 25% of such tanks leak. You examine a SRS of 15 service station tanks.

[10] **(a)** What is the distribution of X, the number of leaking tanks in your sample? Explain thoroughly.

[4] **(b)** What is the mean number of leaking tanks across many samples of size 15?

[4] **(c)** What is the probability that 10 or more of the 15 tanks leak?

[10] **(d)** If you do a larger sample, of 1000 tanks, would it make sense to use the Normal approximation? How do you know? What would this approximation give for the probability that at least 275 tanks leak?

[6] **9** A random sample of female college students found has a mean height of 65 inches, which is greater than the 64 inches of the mean height of all young women in the US. Is each of the underlined numbers a parameter or statistic? Explain.

[8] **10** Theoretical considerations tell us that the mean payoff from a \$1 bet on red in a fair roulette game is 94.7 cents. What does the Law of Large Numbers tell us about the what will happen if a gambler makes many, many bets on red?