Name:

STAT 113 – Midterm 1

1. On questions 1a-e: [2pts] for the correct choice; [0pts] for no choice; [-1pt] for a wrong choice. If more than one choice is correct, any correct choice is fine.

1a $P(A \cup B \cup C) =$ .. *multiple choices*

1b *True* or *False*: If A and B are mutually exclusive, then A and B are independent.

1c $P(A) = \frac{P(A|B)P(B)}{P(B|A)}$ *and some other choices which are wrong..*

1d X rays show that 6 of Missy's 32 teeth have cavities. Unfortunately, her dentis is a bit myopic and drills six of her teeth *at random* (without drilling the same tooth twice). What is the probability that fewer than half of the cavities are properly drilled? The answer is closest to:

(A) 0.0 (B) 0.2 (C) 0.4 ...

2. `Descriptive Statistics`
A college rowing coach tests the 12 members of the women's varsity rowing team on a Stanford Rowing Ergometer (a kind of stationary rowing machine). The variable measured is revolutions of the ergometer's flywheel in a 1-minute session. The data are (already ordered):
400 452 461 461 501 504 506 527 545 545 549 552

a) Finde first quartile (Q_1), third quartile (Q_3) and the median.

b) Draw a box plot.

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--+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 400                    450                    500
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3. `Binomial`
A study by a federal agency concludes that polygraph (lie detctor) tests given to people telling the truth have probability 0.2 of suggesting that the person is lying (Office of Technology Assesment, *Scientific Validity of Polygrpah Testing*, Government Printing Office, Washington DC, 1983).

a) A firm asks 12 job applicants about thethts from previous emplyers, using a polygraph to assess their truthfulness. Suppose that all 12 answer truthfully. What is the probability that the polygraph says at least three are deceptive?

b) Among 12 truthful persons, what is the mean number who will be classified as deceptive?

c) What is the standard deviation of this number?

4. `Probability`

A car was ticketed in Sweden for parking too long in a limited time zone when a policeman recorded the position of the two tire air valves on one side of the car (in the 1 o'clock and 8 o'clock positions) and returned four hours later to find the car in the same space with the air valves in the same position. The driver claimed that he had driven away and returned later to park in the same spot, and that the air valves happened to stop in the same position. The court did not accept the driver's argument, calculating the probability that both valves would stop at their earlier position as $1/12 \cdot 1/12 = 1/144$, which is small enough to preclude reasonable double.

a) What is wrong in this probability calculation?

b) What is the correct probability that both valves would stop at their earlier position?

5. `Mean of a RV`

It is difficult to conduct sample surveys on sensitive issues because many people will not answer questions if the answers might embarrass them.

To ask a sample of tax payers, whether they have ever filed a fraudulent tax return, we ask each person to toss a fair coin twice.

He/she is to answer "Yes" if either (i) the first toss lands *heads* and the person has ever filed a fraudulent return, or (ii) If the first toss lands *tails,* and the second toss lands *tails.*

He/she is to answer "No" otherwise, i.e. if either (iii) The first toss lands *heads* and the person has never filed a fraudulent return, or (iv) the first toss lands *tails*, and the second toss lands *heads.*

Denote with X_i the response of the i-th subject. $X_i = 1$ if "Yes", and $X_i = 0$ if "No". Denote with p the unknown proportion of fraudulent tax returns.

a) Compute the expected value $E(X_i)$ (*Hint:* The answer will be an expression in terms of p).

b) If we ask $n = 100$ tax payers, and record $\overline{X} = 0.6$, compute an estimate of p.