MATH 21-01 (Introductory Statistics, Voronin, S.), Exam #1 (100 points).

You may use a calculator. No books, notes, cell phones or note taking devices. Please show your work for all problems. Clearly state your answer to each question. Sufficient written reasoning and calculation work is required to obtain full credit. Partial credit will be awarded where possible. Start: 9:30 AM. End: 10:20 AM. February 20th, 2017.

Problem I, 20 pts

- (A, 10 pts) A single die is rolled. What is the probability that it shows either an even number or a number under 3 or both?

- (B, 10 pts) Suppose a city has three newspaper: A, B, C. Suppose the probability of someone reading one or more of these is 0.50, the probability of reading A is 0.25, that of B is 0.30, that of both A and B is 0.15, that of both B and C is 0.18, that of both C and A is 0.05 and that of reading all three is 0.02. Find the probability that a person from the city chosen at random reads newspaper C.

Problem II, 20 pts

Suppose 100 twelve year old students are sampled. The recorded weights of the children in pounds (rounded) appear below, with the indicated frequencies:

Weight	Frequency
60	4
63	8
66	12
69	13
72	21
75	15
78	12
81	9
84	4
87	2

Calculate the sample mean, the sample variance, and sample standard deviation of the data. What percent of the data falls in the intervals $x \pm s$ an $x \pm 2s$? How does this compare to the conclusion of the Empirical rule and Chebyshev's theorem? Please indicate the formulas used and show your intermediate work.

Problem III, 15 pts

- (A, 3 pts) Suppose an organization likes to survey the views of MA citizens and permanent residents on Obamacare. Two surveys are proposed. Survey 1 is a voluntary response survey. Survey 2 pays $5 to each person who completes the survey. Which of the two (if any) is likely to produce less bias? Please answer in writing.

- (B, 4 pts) Give one example of ratio, interval, ordinal, and nominal data.

- (C, 4 pts) Suppose for a set of n measurements $x_1, \ldots, x_n$, the standard deviation is found to be zero. What does this imply about the measurements? Justify your answer.

- (D, 4 pts) Suppose in a statistics course at the University of Winnipeg, the grading scheme is as follows: 40% is based on the midterm, 50% is based on final exams, and 10% is based on homework. If a student gets 75% on the midterm, 62% on the final, and 90% avg on the HW, calculate the students final grade out of 100 points.

Problem IV, 20 pts

Consider the following set of exam scores:
$54, 56, 61, 68, 43, 69, 70, 71, 72, 77, 78, 79, 85, 69, 87, 88, 89, 98, 99, 99, 66, 68, 65, 15, 100$.

- (b, 8 pts) Find the five number summary and the IQR. Are there any outliers by the IQR characterization? Draw a modified boxplot of the data.

- (c, 4 pts) What is the mode, range, and midrange of the data set?

- (d, 8 pts) Remove any outliers you found above from the data. Make a histogram of the remaining data using anywhere from 5 to 10 bars. For making the histogram define suitable classes and make a frequency distribution table. Indicate class width and class boundaries. Is the data approximately bell shaped or is it skewed?

Problem V, 25 pts

A card is drawn at random from an ordinary deck of 52 cards. Find the probability that the card is:

- (a, 5 pts) A three of clubs or a six of diamonds.

- (b, 5 pts) Of any suit except for hearts.

- (c, 5 pts) Neither a ten nor a spade.

After the card is drawn, a fair coin is flipped ten times.

- (d, 4 pts) If the first six flips of the coin were tails and the next two heads, what is the probability of getting heads on the last two flips?

Suppose for some events A and B, different from those above, the following probabilities hold: $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}, P(A \cap B) = \frac{1}{6}$.

- (e, 5 pts) Find $P(A \cap B')$.

Some formulas

$$\text{sample std deviation} \quad s = \sqrt{\frac{\sum_{k=1}^{n}(x_k - \bar{x})^2}{n-1}}$$

set relation I : $(A \cap B') \cup (A \cap B) = A$

set relation II : $(A \cap B') \cap (A \cap B) = \emptyset$

set relation III : $(A' \cap B') = (A \cup B)'$

Card deck: 52 card in four suits (clubs, diamonds, hearts, spades). 13 cards of each suit.