Quantitative Methods for Lawyers
Problem Set #1

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Instructions: You may work in groups but each student must do their own work and submit his/her own problem set. If you work with others, please write the names of your other group members in the upper right corner of your problem set. Please show all of your work in order to receive credit. **Due by 3pm - Friday March 22, 2012**. Please submit a **hard copy** to Sue Nelson in Room 465 on or before the deadline.

Problem 1 *Calculating Summary Statistics*

For the Hypothetical Dataset of Exam Scores: 42, 50, 51, 51, 53, 54, 55, 55, 55, 62, 64, 68, 73, 77, 77, 78, 79, 79, 79, 80, 81, 81, 81, 81, 82, 82, 86, 86, 86, 87, 87, 87, 88, 90, 90, 90, 90, 91, 94, 94 98, 99

(a) Calculate the Range

(b) Calculate IQR

(c) Sketch a Box and Whisker Plot

(d) Calculate (By Hand or Using Excel) the following: the Mean, Variance and Standard Deviation of the Distribution. Please show all of your work (including as necessary your excel output/formula).

(e) Please Calculate the Skewness of the Distribution and briefly describe (in words) the resulting calculation (including labeling it using the forms of Skewness presented in this class) Please show all of your work (including as necessary your excel output/formula).

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Problem 2 *Conditional Probability*

Assume you are observing someone rolling a pair of dice. Further assume the dice are fair and six sided. What is the probability of someone rolling a 5 if you somehow happen to know that the number thrown is less than 10? Please show all of your work.

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Problem 3 *Binomial Distribution and Hypothesis Testing*

(a) Calculate the probability of flipping heads (with a fair coin) in at least 10 out of 12 trials. Please show all of your work.

(b) Using an $\alpha = 0.05$, if you observed an someone flip 10 out 12 heads - would you be prepared to conclude that the coin was unfair? Please evaluate this proposition. State the null and alternative hypotheses, calculate and explain your conclusion using the precise language of hypothesis testing. Please show all of your work.

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Problem 4 *Hypothesis Testing*

Some expert claims that the probability of each person owning an *IPhone* at Michigan State University is 14%. It is observed that out of 50 randomly sampled people at MSU, only 6 people owned an *IPhone*.

Using an $\alpha = 0.05$, is there sufficient evidence to conclude that the population proportion differs from 17%? State the null and alternative hypotheses, calculate and explain your conclusion using the precise language of hypothesis testing. Please show all of your work.

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Problem 5 *Expected Value*

A standard deck of cards contains 52 cards. Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K.
Assume we assign a points to these cards as follows:

- For all number cards (2, 3, 4, 5, 6, 7, 8, 9, 10) assign points equal to the number shown on card
- J = 15 points, Q = 25 points, K = 35 points
- Aces are Worth 45 Points

Calculate the Expected Value (Expected Points) for the Draw of a Card from Standard Deck containing 52 cards. Please show all of your work.

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Problem 6 *Bayes Rule*

Imagine you are scheduled to take a Flight between City A and City B. Assume there is exactly 1 flight per day and there is a flight every day of the year (365 days per year). Historically, the flight is on time 62% of the time.

While waiting at the gate at the airport, you bump into Ryan 'Up in the Air' Bingham. Ryan is an expert flier who has logged more than 10,000,000 miles on this airline. Through this experience, he has (or at least believes that he has) developed the ability to predict when a flight will or will not be on time.

Ryan takes a look around and tells you "listen I have bad news - I predict that this flight is going to be delayed." Since you have a very tight connecting flight, you wonder whether given Ryan's prediction you have cause to be worried.

You ask Ryan a few quick questions in order to try to determine whether he actually has the ability to predict on time performance. During that conversation he reveals that when a flight is late, he correctly forecasts a delay 73% of the time. When it is on time, he incorrectly forecasts a delay 16% of the time.

In light of all of the information above – what is the probability that you flight will be on time? From a Bayesian perspective, was Ryan's prediction actually helpful?

Please show all of your work.

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Problem 7 *Research Design*

Please Complete Question #5 on Page 51 of Lawless, Robbennolt & Ulen. Please show all of your work.

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Problem 8 *Survey Design*

Please Complete Question #4 on Page 90 of Lawless, Robbennolt & Ulen. Please show all of your work.

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Problem 9 *Sampling*

Please Complete Question #4 on Page 163 of Lawless, Robbennolt & Ulen. Please show all of your work.

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