MAT 1372 Statistics with Probability Practice Final Exam **Answers to Part I** Fall 2013

*Exam will be done in 2 parts. Once you have submitted part 1, you may work on part 2.*

**Part1: No Excel. You may use a graphing calculator on part 1 but you may not rely on any of the statistical/probabilistic functions/tools. You should make use of the formula sheet that you prepared. Submit the formula sheet as part of your exam for 10% of your exam grade.**

15 pts for each problem.

1. A fair coin is tossed (0 tail, 1 head) and a fair die (1,2,3,4) is rolled.
   1. List the sample space as a set of coordinates: (coin, die)

**S={(0,1),(0,2),(0,3),(0,4),(1,1),(1,2),(1,3),(1,4)}**

* 1. Write the event A= “sum of coordinates is 2 or 3” as a subset of the sample space

**A={(0,2),(0,3),(1,1),(1,2)}**

* 1. Write the event B= “1st coordinate is 0” as a subset of the sample space

**B={(0,1),(0,2),(0,3),(0,4)}**

* 1. Write the event A∩B= as subset of the sample space.

**A∩B={(0,2),(0,3)}**

* 1. Determine P(A), P(B) and P(A and B).

**P(A)=.5, P(B)=.5 and P(A and B)=.25.**

* 1. Are A and B independent?

**Yes, P(A)\*P(B)=.25=P(A∩B)**

1. The distribution of grades on a quiz taken

by 100 students is given in the table:

1. Compute the mean and standard deviation of this distribution.



1. Find mean & standard deviation of sample mean for random sample of size n=16.

**µ=2.6, SD(Xbar)= σ/sqrt(n)= 0.92/sqrt(16)= 0.92/4=.23**

(c) What value of n is needed so that the sample standard deviation is .1?

**σ/sqrt(n)=0.92/sqrt(n)=.1 ⇒ n=(0.92/.1)^2=85**

1. 4% of a clinic’s patients are known to have Lyme’s disease. A test is developed that is positive in 98% of patients with Lyme’s disease, but it is also positive in 3% of patients who do not have disease. Fill in the following table (use all available digits).





1. What is probability that test comes out positive for Lyme’s disease?

**.04\*.98+.96\*.03=.068**

1. What is probability that person has Lyme’s disease given positive test?

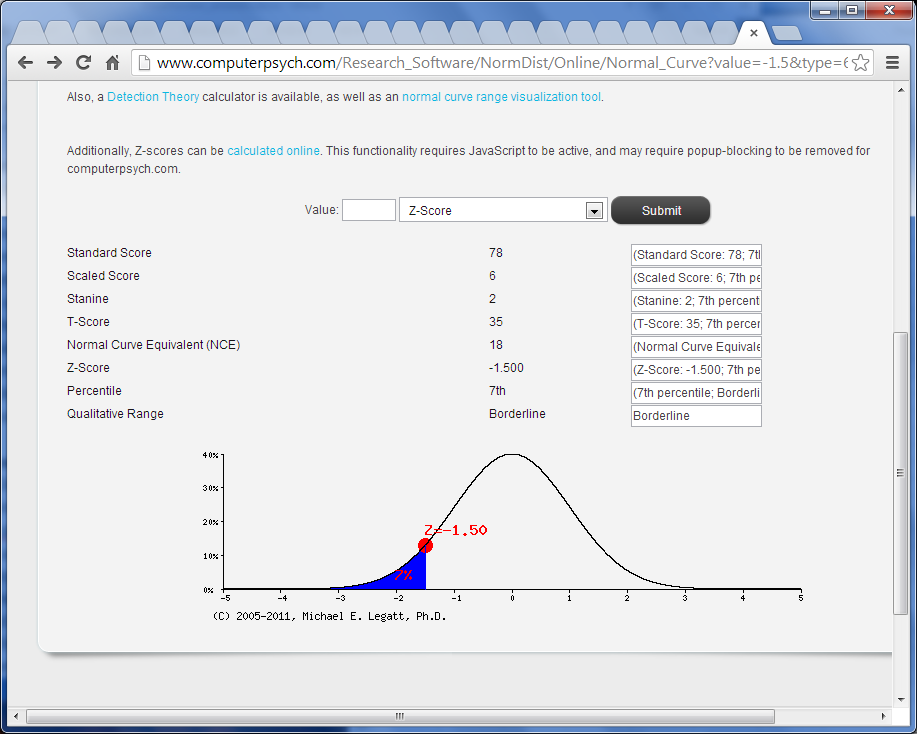
**P(Yes|positive)=P(Yes∩positive)/ P(Yes∩positive)=.0392/.068=.576 or about 58%.**

In other words, there is a 42% chance of a **false positive**.

1. A manufacturer wants to know if an experimental version of its child toothpaste works better to prevent tooth decay than the existing formula. For children using its existing formula, cavities per year are normal with mean 3 and standard deviation 1. A study of 900 children using the new version found an average of 2.95 cavities. \*Can we, at the 5 percent level of significance, establish that the new version is better? (H0:μ≥3)
2. Calculate the standard deviation for the sample mean.

**SD(Xbar)= σ/sqrt(n)= 1/sqrt(900)= 1/30**

1. Draw the normal curve and label sample mean, mean plus/minus SD, mean plus/minus 2SD and the average experimental value. Sketch in appropriate tail.



2.93 2.97 3 3.03 3.07

1. Standardize and add Z axis to the curve from b).

**(2.95 − 3)/(1/30)= −1.5**

1. Write down but do not evaluate the appropriate Excel command.

**Normsdist(-1.5)**

1. The answer to (d) turns out to be 6.7%. Please use to answer the question\*.

**The p-value is above the threshold (α) level of 5%, so no, we cannot say that the new toothpaste formula is better.** We have evidence that it is better, but not enough to give a definitive answer.

**Answers to Part II (problems 5 and 6) can be found in the Excel file.**