Please prepare a 2 page, one sheet, handwritten formula sheet.

Submit as part of your exam for up to 5% extra credit.

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

Part1: No Excel. Use instead a graphing calculator if needed.

Problems similar to 2 of the following 4 problems will appear (25 pts for each problem).

1.   A fair coin is tossed (0 tail, 1 head) and a fair die (1,2,3,4) is rolled.

   a. 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)}

   b. Write the event A= "sum of coordinates is 2 or 3" as set and find P(A).

 A={(0,2),(0,3),(1,1),(1,2)}, P(A)=.5

   c. Write the event B= "1st coordinate is 0" as a set and find P(B).

  B={(0,1),(0,2),(0,3),(0,4)}, P(B)=.5

   d. Write the event A∩B as a set and find P(A∩B).

  A∩B={(0,2),(0,3)}, P(A and B)=.25

   e. Are A and B independent?

  Yes, P(A)*P(B)=.25=P(A∩B)

grade	number	portion	mean prods	devs^2	var prods
1	12	0.12	0.12	2.3716	0.284592
2	41	0.41	0.82	0.2916	0.119556
3	28	0.28	0.84	0.2116	0.059248
4	19	0.19	0.76	2.1316	0.405004
total 100			mean 2.54	var	0.8684
				std dev	0.93

2.   The distribution of grades on a quiz taken
          by 100 students is given in the table:

grade	number	portion	mean prods	devs^2	var prods
1	12	0.12	0.12	2.3716	0.284592
2	41	0.41	0.82	0.2916	0.119556
3	28	0.28	0.84	0.2116	0.059248
4	19	0.19	0.76	2.1316	0.405004
total 100			mean 2.54	var	0.8684
				std dev	0.93

   (a) Compute the mean and standard deviation of this distribution.

   (b) Find mean & standard deviation of sample mean for random sample of size n=16.
   Sample mean's mean stays the same (2.54).
   The std err (std dev for sample mean) = .93/sqrt(16)=.23

   (c) What value of n is needed so that the sample standard deviation is .1?
   .93/sqrt(n)=.1, solving for n gives sqrt(n)=.93/.1 or n=(9.3)^2=86.5 or 87 (n is integer).
   H$_0$: μ=11.2
   H$_1$: μ≠11.2
   α=5% (default)

3.   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).

Test\Lyme's disease	Yes	No	Total
positive	.04*.98	.96*.03	.04*.98+.96*.03
negative	.04*.02	.96*.97	.04*.02+.96*.97
Total	0.04	0.96	1

Test\Lyme's disease	Yes	No	Total
positive	0.0392	0.0288	0.068
negative	0.0008	0.9312	0.932
Total	0.04	0.96	1

(a) What is probability that test comes out positive for Lyme's disease?
.04*.98+.96*.03=.068

(b) What is probability that a person has Lyme's disease given positive test?
P(Yes|positive)=P(Yes∩positive)/ P(positive)=.0392/.068=.576 or about 58%.
In other words, there is a 42% chance of a **false positive**.

(c) What is probability that a person has disease given a negative test (false negative)?
P(Yes|negative)=P(Yes∩ negative)/ P(negative)=.0008/.932= .0009 or about .1%
This is typical; oftentimes false positives are more common than false negatives.

4. A manufacturer wants to know if an experimental version of its child toothpaste differs in its ability to prevent tooth decay from the existing formula. For children using its existing formula, cavities per yr. are normal with mean 3.03 & standard deviation 1.12. A study of 100 children using new version found average of 2.83 cavities. **Two tailed**.

(a) Calculate the SE (standard error, the standard deviation for the sample mean).

(b) **SD(Xbar)= σ/sqrt(n)= 1.12/sqrt(100)= .112**

(c) Draw the normal curve and label sample mean, mean plus/minus SE, mean plus/minus 2SE and the average experimental value. Sketch in appropriate tail.

P-Value=0.0734

test z=-1.79

2.81   2.92   3.03   3.14   3.25
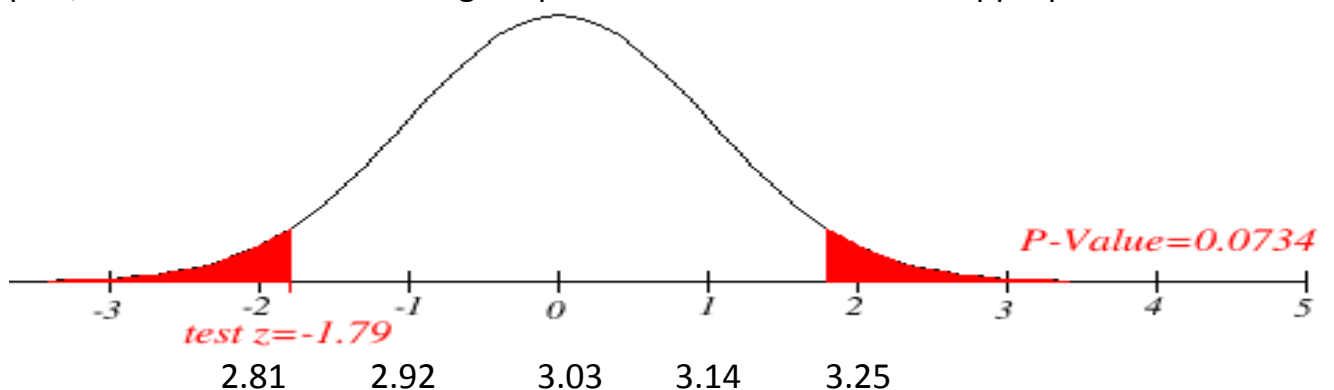
(d) Standardize and mark off the z-value on the Z labeling of the horizontal axis in b).
(2.83 – 3.03)/(.11)= -.20/.112=-1.79

(e) Use your calculator to find the p-value.
2*Normalcdf(-1E99,-1.79)=2*3.7%=7.4%

(f) Does the experimental version's cavity prevention differ from the existing formula?
Since the pvalue is more than α=5%, we do NOT reject the H₀. In other words, we cannot say that the cavity prevention of the experimental version differs from that of the existing formula.

Part 2: Down- and up-load the Excel file from Blackboard.
Please make sure your name becomes part of the file name.
Problems similar to each of the following problems will appear (25 pts each).

5. The FDA has decided to measure 8-ounce cans of Hershey Cocoa. The weights of 50 containers are found in the accompanying excel file. **Single tailed.**
    a. Make a histogram to verify that the weights are approximately normally distributed and describe any skewing.
    b. Use the data to calculate the sample standard deviation and mean.
    c. Find the SE (standard error, the standard deviation for the sample mean).
    d. Use an appropriate test and the p-value approach to determine if the cans do not contain the claimed weight.

6. Do people spend more time reading ads that agree with their disposition? An antismoking group conducted a survey asking those who saw an advertisement against smoking if (1) they read headline only, (2) some detail, or (3) most of advertisement. The questionnaire asks respondents to identify themselves as heavy smokers (1), moderate smokers (2), light smokers (3) or nonsmokers (4). The result is found in the accompanying excel file (col A: type of smoker, col B: amt of advertisement read). Does how much you smoke affect how much you read of an antismoking advertisement? Use a pvalue approach at the 10% level.