Final Exam Winter 2022@ Stat 474/574

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Due by April 28, 2022 4:15PM

**Problem 1**

Test the randomness of each of the following sequences:

(i) 1 2 3 4 5 6 7 4 4 4 4 4 4  
(ii) T F T F T T F T T T F T T T  
(iii) D D D D D D D D N N N  
(iv) 12 13 11 11 8 12 12 9 9 5 8 8  
(v) -1 1 -1 -1 1 1 -1 -1 1 -1 1 -1

at significance level .

**Problem 2**

Given the following sequence of number

9 8 9 3 9 9 6 4 9 6 3 8 8 5 8

1. Determine the number of runs by comparing each number with the medians.
2. Determine the number of runs by comparing each with the previous number.

**Problem 3**

The failure time of a certain product follows an exponential distribution with mean of 3075 days.

1. Find the MTTF of the product.
2. Find the reliability of the product at days.
3. Find the probability that the item will survive to its MTTF.

**Problem 4**

A production system consists of three 3 independent components whose time to failures follow exponential distributions with rates days.

Compute the probability that component will fail first.

**Problem 5**

Time to failure of a diesel engine compressor cooling system follows an Weibull distribution with a shape parameter and a scale parameter . Compute the following quantities:

1. Compute the reliability function and evaluate it at .
2. Compute the mean time to failure (MTTF)
3. Compute the mean residual life at time and evaluate it at .
4. Write the expression for the failure rate function and evaluate it at .

**Problem 6**

The data vector below is assumed to come from an distribution with and unknown.

x=scan(text="1.51 1.41 1.75 1.32 1.30 0.84 1.17 0.65 1.26 1.14 1.74 1.00 1.29 0.89 1.81 0.67 0.63 1.20 1.92 1.33 0.64 1.59 1.09 1.49 1.72 1.39 0.97 1.67 0.73 1.58 0.95 1.12 1.01 1.28 0.96 1.10 1.47 0.83 0.66 1.08 0.52 0.50 0.87 1.43 0.38")

1. Estimate and using any of the R function discussed in the class.
2. Use the estimated parameters to test if the data actually come from the hypothesized Weibull distribution.

**Problem 7**

Given the following ordered pair (x,y):

x: 14.8 13.3 14.9 14.5 13.9 15.7 12.7 16.5 16.6 15.3 14.5 16.6 12.8 15.8 12.8  
y: 15.2 12.3 14.5 17.6 16.0 14.5 14.1 15.1 10.9 15.7 13.5 11.4 12.4 16.2 12.8

1. Test against the two sided alternative using any appropriate test.
2. Perform a permutation test for the above test using 5000 permutation samples.
3. What is your conclusion about the test? Use significance level .