

Past Test Questions

2. (15%) **(2016 Test)** A professor claims that 50% of his students in a large class achieve a final score 90 points or higher. A suspicious student asks 17 randomly selected students from the professor's class and they report the following scores.

80 81 87 94 79 78 89 90 92 88 81 79 82 79 77 89 90

Do the data suggest that the professor's claim is not consistent with the evidence, i.e., that the median is not equal to 90? Perform the binomial test at the 5% significance level and also obtain the exact p -value of the test.

8. (25%) **(2016 Exam)** A statistics course has two tutorial classes conducted by two tutors, Amy and Emily. Students of this course were given a mid-term test and some students were randomly drawn from each of two tutorial classes and their test scores are shown below:

Amy's class	82	74	87	86	75				
Emily's class	88	77	91	88	94	93	83	94	

We are testing the null hypothesis that there is no difference in statistics ability, as measured by this test, in the two classes.

- State your null and alternative hypotheses with appropriate notation.
 - Carry out Mann-Whitney test and state your conclusion with 5% significance level by using the critical value approach.
 - Someone commented that "Rejecting the null hypothesis implies that one of the tutors should perform better.". Do you agree? Give a reason to support your argument.
 - Denote $F_A(x)$ and $F_E(x)$ as the cumulative distribution functions of a test score x received by a student in Amy's class and Emily's class, respectively. Find an approximate 90% confidence interval for $F_A(85) - F_E(85)$.
4. (20%) **(2016 Test)** Four share tipsters are each asked to predict on 10 randomly selected days whether the Hong Kong Hang Seng Index will rise or fall on the following day. If they predict correctly this is scored as 1, if incorrectly as 0.

Day	1	2	3	4	5	6	7	8	9	10
Tipster A	1	0	0	1	1	1	1	0	1	1
Tipster B	1	1	1	1	0	1	1	0	0	0
Tipster C	1	1	0	1	1	1	1	1	0	1
Tipster D	1	1	0	0	0	1	1	1	0	1

- Do the scores below indicate differences in tipsters' ability to predict accurately at the 5% significance level? You may assume that the sample is large enough to apply large sample approximation.
- Someone comments that Tipster C may have the ability to predict the trend of the Index. Can your result in part (a) help support or against this? Explain.

1. **(2015 Exam)** The following data give the time in hours to two different types of tyre failure under similar test conditions. Failure type A is rubber chunking on shoulder. Failure type B is cracking of the side wall.

Type A	177	227	268	297	
Type B	47	126	158	197	225

We are testing the hypothesis that Type A tends to have longer failure time than Type B.

- (a) State your null and alternative hypotheses with appropriate notation.
 - (b) Carry out Wilcoxon's rank sum test and state your conclusion with 5% significance level by using the critical value approach.
 - (c) Define the test statistic $T = \bar{X} - \bar{Y}$ as the sample mean difference, where \bar{X} and \bar{Y} denote the sample means from Types A and B, respectively. Describe the procedure for the permutation test based on T .
 - (d) Compute the Hodges-Lehmann estimator for the difference parameter Δ and construct its associated 90% confidence interval.
2. **(2015 Test)** Obtain the permutation distribution of the Ansari-Bradley statistic under the null hypothesis of no difference between the two scale parameters based on two independent samples of sizes $m = 2$ and $n = 4$.
 3. **(2014 Test)** At the beginning of a tutorial 12 names are read out in random order to 10 arts students. Four are names of prominent sporting personalities (Group A), four are national and international politicians (Group B), and four are scientists who regularly feature in the media (Group C). At the end of the session students are asked to recall as many of the names as possible. The numbers recalled were:

Student	1	2	3	4	5	6	7	8	9	10
Group A	3	1	2	4	3	1	3	3	2	4
Group B	2	1	3	3	2	0	2	2	2	3
Group C	0	0	1	2	2	0	4	1	0	2

- (a) We are interested in testing whether there is a difference between recall rates for the three groups. State the null and alternative hypotheses with appropriate notation.
- (b) Calculate Friedman's test statistic for the hypothesis given in (a).
- (c) Using the chi-square approximation, carry out Friedman's test at 1% significance level.
- (d) Describe the procedure of calculating the p -value of Friedman's test using permutation.

5. (20%) **(2014 Exam)** Four judges ranked each of six contestants in a diving contest. Their rankings of the six contestants are given below.

	Ranks of contestants					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
Judge 1	4	3	1	2	6	5
Judge 2	5	2	3	1	6	4
Judge 3	2	5	1	3	4	6
Judge 4	3	4	2	1	5	6

- (a) Using the chi-square approximation, perform Friedman's test to test for agreement among the judges' rankings at the 5% significance level.
- (b) Perform a test to see whether six contestants are performed in the order: $E \geq F \geq A \geq B \geq C \geq D$, with strict inequality holding for at least two contestants, at the 5% significance level.
12. (15%) **(2016 Test)** A poll was conducted to determine if perceptions of the hazards of smoking were dependent on whether or not the person smoked. One hundred people were randomly selected and surveyed. The results are given below.

	Very	Somewhat		Not
	Dangerous	Dangerous	Dangerous	Dangerous
Smokers	11	15	14	9
Non-smokers	26	16	6	3

Perform a chi-square test to determine whether or not smoking status affects perception of the dangers of smoking at the 5% significance level. Do you think that the chi-square approximation is valid here? Explain.