



Department: Mathematics Course NO: Stat 302 Course name: Statistical Inference II  
Group: Mathematical statistics & Computer Science Exam total pages: 2  
Exam date: 25/5/2024 Exam total marks: 105 Exam time: 3 hours

- 1) Let  $X_1, X_2, \dots, X_n$  be a random sample from a normal population with mean  $\mu$  and known variance  $\sigma_0^2$ . Test the null hypothesis  $H_0: \mu = \mu_0$  against  $H_1: \mu \neq \mu_0$ . (18 Marks)

- 2) The side effects of a new drug are being tested against a placebo. A simple random sample of 565 patients yields the results below. At a significance level of  $\alpha = 0.05$ , is there enough evidence to conclude that the treatment is independent of the side effect of nausea?

$(\chi^2_{0.05}(1) = 3.841)$

(22 Marks)

	$A_1$	$A_2$	
Result	Drug	Placebo	Total
$B_1$ Nausea	36	13	49
$B_2$ No nausea	254	262	516
Total	290	275	565

- 3) a) Define type I error and type II error.

(6 Marks)

- b) Suppose the manufacturer of a new medication wants to test  $H_0: \theta = 0.9$  against  $H_1: \theta = 0.6$ . His test statistic is  $X$  the observed number of successes in  $n=20$  trials, and will accept  $H_0$  if  $x \geq 15$ . Evaluate the probabilities  $\alpha$  and  $\beta$ .

(14 Marks)

- 4) a) P-value is 0.0219. If the level of significance is 5%, find if we can reject the null hypothesis.

(5 Marks)

- b) Suppose we conduct a two-tailed hypothesis test and get a z-score of -0.84. What is the p-value that corresponds to this z-score? [ $\phi(0.84) = 0.7995$ ]

(10 Marks)

5) a) Define: Simple likelihood ratio test.

(5 Marks)

b) Let  $X_1, X_2, \dots, X_n$  be a random sample from a normal distribution with mean  $\mu$  and variance 1. Find the most powerful test for testing  $H_0: \mu=0$  versus  $H_1: \mu=1$ .

المسألة (15 Marks)

6) Put true or false and correct the false (10 Marks)

- a) P-value is the lowest significance level  $\alpha$  that results in rejecting the null hypothesis.
- b) The power of the test is equal to  $1-\alpha$ .
- c) Calculating the P-value depends on the null hypothesis.
- d) A chi-square test of independence is used to test whether two categorical variables are related to each other.

e) Here are some defective goods for weekdays.

Mon	Tue	Wed	Thu	Fri
15	20	20	23	12

The expected frequency is 19.  $E_i$

Good Luck