1. Describe or define the following statistical terms with examples.(50 points)
   a. subjective probability and objective probability
   b. universe and population
   c. independent and dependent events
   d. coefficient of simple correlation and coefficient of partial correlation
   e. p-value and α-value (significance level) of a statistical test
   f. type I error and type II error
   g. observational and experimental data
   h. time series components
   i. fixed and random factors in an ANOVA model
   j. sampling distribution of an estimator

2. Suppose we attempt to predict Y using three predictor variables, the prediction equation is $\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{\beta}_3 x_3$. The following set of data was collected and the table of ANOVA was shown below.

x1	5	10	15	20	25	30	35	40	45	50
x2	20	30	40	50	60	70	80	90	100	110
x3	100	90	80	70	60	50	40	30	20	10
y	171	176	178	185	192	201	198	212	224	221

ANOVA

	df	SS	MS	F	P-value
Regression	3	1727.348485	575.7828	16.23818	0.002763
Residual	6	212.7515152	35.45859		
Total	9	1940.1			

	Coefficients	Standard Error	t Stat	P-value
intercept	116.9232493	59703746.68	1.96×10^{-6}	0.999999
x1	1.461370003	7240142.759	2.02×10^{-7}	1
x2	0.168067227	2564039.766	6.55×10^{-8}	1
x3	0.441176471	874330.3034	5.05×10^{-7}	1

   a. Explain the contradiction between the result suggested by the analysis of variance F test and the result showed by t test of individual β. (10 points)

〈背面繼續〉

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註 ： 本次考試不可以參考書籍及筆記；不可以使用字典； 可以使用計算器

〈接前頁〉

b. Calculate $\sqrt{R^2}$ and explain its meaning in the above multiple linear regression model. (Note: R^2 is the coefficient of determination) (10 points)

3. Do the following data appear to come from a binomial distribution with $p=0.5$? Test using a 0.05 significance level. (15 points)

$(\chi^2_{0.05,3} = 7.81473, \chi^2_{0.05,4} = 9.48773, \chi^2_{0.05,5} = 11.0705)$

Value of Binomial Random Variable	0	1	2	3	4	5
Observed Frequency	2	11	34	31	18	5

4. The joint probability of Y_1 and Y_2 is given by $p(y_1, y_2) = \dfrac{\binom{4}{y_1}\binom{3}{y_2}\binom{2}{3-y_1-y_2}}{\binom{9}{3}}$

where y_1 and y_2 are integers, $0 \le y_1 \le 3$, $0 \le y_2 \le 3$, and $0 \le y_1 + y_2 \le 3$. Find $E(Y_1 + Y_2)$ and $V(Y_1 + Y_2)$. (15 points)