Multiple Choice Questions: <u>You do not need to show detailed steps</u> (單選題 50%，無需列出計算過程).

I. Questions 1-10 : 2 points each (以下每題 2 分)

(Question 1~3) A researcher is interested in investigating wages of college graduates in Taiwan. He randomly draws 1,200 graduates and obtains the following regression (Assume that all the college graduates in the sample answer questions properly):

$$\ln(wage) = \beta_0 + \beta_1 (Years\ of\ Schooling) + \beta_2 (Working\ Experience) + \xi$$

where ξ is a normally distributed error term. Suppose the standard deviation of ln(*wage*) equals 0.91 and the calculated SSR (Sum of Square Regression) equals to 752.60. The estimated regression is shown as follows:

$$\ln(wage) = \underset{(0.006)}{3.67} + \underset{(0.006)}{0.25} \times (Years\ of\ Schooling) + \underset{(0.03)}{0.09} \times (Work\ Experience) + \xi$$

Values in parentheses are the associated estimated standard errors.

Please answer the following questions:

1. What is the value of SST (Sum of Square Total)
   (a). 752.60 (b). 1902.53 (c). 1896.49 (d). 2649.10
2. What is the degree of freedom (*d.f*). of SSE (Sum of Square Error)
   (a). 2 (b). 3 (c). 3197 (d). 3199
3. What is the value of R^2
   (a). 0.7259 (b). 0.2841 (c). 0.1183 (d). 0.8817

4. A set of 32 observations of two variables *X* and *Y* produces the following statistics:
   $\sum x = 42.5, \sum y = 119, \sum xy = 144.1, \sum x^2 = 217.8, \sum y^2 = 636.4$
   A simple linear regression of *y* on *x* is fitted. What is the estimated coefficient of *x* ?
   (a). -0.08644 (b). -1.29 (c). -0.96 (d). 1.26 (e). none of the above

(Question 5, 6) Please answer the following questions based on the ANOVA table below.

Source	*df*	*SS*	*MS*	*F*
Block	4	138.30	-	-
Treatment	4	66.76	-	-
Error	-	-		
Total	20	259.26		

It is know that the critical values of the above *F* tests based on α=0.10, 0.05, 0.025, and 0.01 are 2.48, 3.26, 4.12, and 5.41, respectively.

5. To test for the treatment effect, the associated *p* value is
   (a). greater than 10% (b). between 5% and 10% (c). between 2.5% and 5%
   (d). between 1% and 2.5% (e). less than 1%

6. To test for the block effect, the associated *p* value is
   (a). greater than 10% (b). between 5% and 10% (c). between 2.5% and 5%
   (d). between 1% and 2.5% (e). less than 1%

7. A randomized block experimental design will
   (a) divide available experimental units into distinctly different, but internally homogeneous blocks.
   (b). be analyzed in a two-factor ANOVA framework.
   (c). randomly match each treatment with one or more units within any given block.
   (d). all of the above are correct.

8. Which of the following answer is mostly correct? The Chi-square statistic can be used
   (a). to test the homogeneity of two populations.
   (b). to conduct a goodness-of-fit test.
   (c). to make inferences about population variance.
   (d). all of the above

9. Which of the following statements is false? Using the nonparametric test,
   (a). we need fewer distributional assumptions than the corresponding parametric test .
   (b). its testing power is smaller than that of the corresponding parametric test.
   (c). the type II error rate is expected to be smaller than that of the corresponding parametric test
   (d). it is insensitive to extreme observations in relation to the corresponding parametric test.

10. A Wilcoxon rank sum test is most similar to which of the following test?
   (a) A Wilcoxon signed rank test. (b) A Friedman test. (c) A Kruskal-Wallis test.
   (d) A Mann-Whitney test.

II. Questions 11-20 : 3 points each (以下每題 3 分)

11. (Question 11 and 12) The prior probabilities of the stock index to go up, remain unchanged and decline are 0.5, 0.1 and 0.4, respectively. We try to improve the predicting power of the index by incorporating the information provided by a stock analyst. According to historical records, given that the index went up, the conditional probabilities, predicted by the analyst, that the index would go up, remain unchanged and decline are 0.8, 0.1 and 0.1, respectively. Given that the stock index remained unchanged, the conditional probabilities, predicted by the analyst that the index would go up, remain unchanged and decline are 0.2, 0.5 and 0.3, respectively. Given the stock index declined, the conditional probabilities, predicted by the analyst, that the index would be up, remain unchanged and go down are 0.2, 0.2 and 0.6, respectively.
   What is the (conditional) probability that the index goes up, given that the analyst predicted the index will go up?
   (a). 0.2 (b). 0.25 (c). 0.64 (d). 0.8 (e). None of the above

12. Following question 11, what is the (conditional) probability that the index **does not** decline, given that the analyst predicted the index will decline?
   (a). 0.25 (b). 0.32 (c). 0.75 (d). 0.68 (e). none of the above

13. (Question 13 and 14) Suppose the *p.d.f.* of a random variable X is $f(x)=\frac{1}{4}e^{-x/4}$, $0<x<\infty$.
   Consider a random sample of size=16 and use Normal approximation to estimate $P(48<\sum_{i=1}^{16}x_i<64)$. The estimate is close to:
   (a). 0.0987 (b). 0.3413 (c). 0.4772 (d). 0.8185 (e). none of the above

14. Following question 13, use Chebyshev inequality to find the lower bound of $P(32<\sum X<98)$, which is
   (a). 1/64. (b). 63/64 (c). 1/8. (d). 7/8 (e). none of the above

15. (Question 15 and 16) Let $X_1, X_2, ..., X_8$ be a random sample of size 8 from the distribution with *p.d.f.* $f(x)=1/x^2$, $1<x<\infty$. The probability that exactly 6 of these random variables have the value greater than 2 is close to? (Hint: Let the ith trial be success if $X_i>2$, $i=1...8$)?
   (a). 0.0547 (b). 0.1094 (c). 0.2186 (d). 0.4375 (e). none of the above

16. Following question 15, the probability that at most 2 of these random variables have the value less than 3 is close to?
   (a). 0.0197 (b). 0.0393 (c). 0.056 (d). 0.1771 (e). none of the above

17. Suppose that the waiting time for the good news and the waiting time for the bad news in the stock market are independent, and both of them follow the exponential distribution with means of 6 days and 3 days, respectively. What is the probability that the good news is coming

within 3 days and the bad news is coming within 2 days?

(a). $\frac{1}{18}(1-e^{-2/3}-e^{-1/2}+e^{-7/6})$ (b). $\frac{1}{18}e^{-7/6}$ (c). $1-e^{-2/3}-e^{-1/2}+e^{-7/6}$

(d). $1-e^{-2/3}-e^{-1/2}+e^{-1/3}$ (e). $1-\frac{1}{3}e^{-2/3}-\frac{1}{6}e^{-1/2}+\frac{1}{18}e^{-7/6}$

18. A researcher conducts a ten-week study of patients infected with a disease. The researcher finds that the fraction of patients showing severe symptoms can be modeled as $F(t)=te^{-t}$, where t is time elapsed (in weeks) since the study began. What is the minimum fraction of patients showing severe symptoms between the end of first week and the end of the seventh week?

(a). $e^{-1}-7e^{-7}$ (b). e^{-1} (c). $(1/7)e^{-(1/7)}$ (d). $4e^{-4}$ (e). $7e^{-7}$

19. Suppose the frequency of stock price jumps during a month follows a Poisson distribution with parameter λ. To test whether the mean frequency is H_0: λ=3 or H_1:λ=2, we observe only one month data, and the decision rule is : Reject H_0 if the jump is equal to or less than two times. Find the testing power (1- β) of this test?

(a). $\sum_{3}^{\infty}\frac{2^x e^{-2}}{x!}$ (b). $3e^{-5}$ (c). $5e^{-3}$ (d). $5e^{-2}$ (e). $2e^{-3}$

20. The *p.d.f.* of random variable X is: $f(x)=\frac{1}{\theta}, 0<x<\theta$ (i.e., a Uniform distribution). To test $H_0:\theta=4$; vs. $H_a:\theta=3$ and let $x<2$ be the reject region. The probability of Type II error (β) of this test is

(a). 1/2 (b). 2/3. (c). 1/3 (d). 1/4 (e). none of the above is true.

III. You must write down detailed steps showing how you get your answers to get the credits. (列出詳細的計算過程才能獲得分數).

1. (10 points) An automobile financing corporation wishes to understand whether martial status has any influence on whether a new car loan becomes delinquent within the first year. A random sample of 950 approved financing applications is collected, and its statistics are summarized in the table below. Use both "Test of independence" and "the equality test of two proportions" to conduct this test based on $\alpha=0.05$, ($\chi^2_{1,0.05}=3.84$) (As you know, they are equivalent tests.)

Martial Status	Number of Loans Non-delinquent	Number of loan become delinquent
Unmarried	241	31
Married	409	39

2. (10 points) Suppose we want to estimate a simple saving function that relates personal savings (Y) to disposable personal income (X) of a country. The data period starts from year 1970 to year 2005 (36 observations). Now we obtain an OLS regression of Y on X. The results are given as follows (the value in parentheses is the associated t statistic).

Time period:1970-2005

$$\hat{Y}_t = 62.4226 + 0.0376X_t$$

$$(4.8917) \quad (8.8937) \qquad R^2 = 0.7672 \qquad (1)$$

(a) Now suppose the country suffers a severe recession in 1982 (a structural break). Therefore, can you still use the above results? If not, why? (4%)

(b) If you split the data into two sub-samples and run the following regression models:

Time period:1970-1981.

$$\hat{Y}_t = 1.0161 + 0.0803X_t \qquad (2)$$

(0.0873) (9.6015) $R^2 = 0.9021$

Time period:1982-2005

$$\hat{Y}_t = 153.4947 + 0.0148X_t \qquad (3)$$

(4.6922) (1.7707) $R^2 = 0.2071$

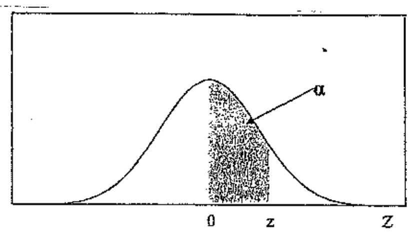
Explain and discuss what you find from the above regression results. (6%)

3. (15 points) (*Minimum Variance Portfolio*) Suppose your portfolio includes only two securities (***S**tock* and ***B**ond*). According to the historical data, the correlation coefficient between X and Y is: ρ_{SB} = -0.5, and the expected rates of return are 12% and 4% for S and B respectively. In addition, it is also given that $E(X^2) = 0.6544$ ， $E(Y^2) = 0.3664$. What is the weight (w) of your money that should be put in *Stock* (i.e., (1-w) is put in *Bond*) that can **minimize** the variance of your portfolio R? (i.e., you need to minimize Var(R)=Var(wS+(1-w)B).

4. (15 points) The government claims that the percentage of people against ECFA is lower than 30%. Obtain a sample of size=100 (persons). The decision rule is that, if there are over 40 persons against ECFA, then we should reject the null hypothesis. (a). What is the probability of type I error (α). (5%) It is known that the true probability that people is against ECFA is 35%. (b). If we wish the testing power to be at least 0.9,what is the minimum sample size (n) we need? (you must show how you get n in details.) (10%).

附表 Table， 標準常態累加機率值表

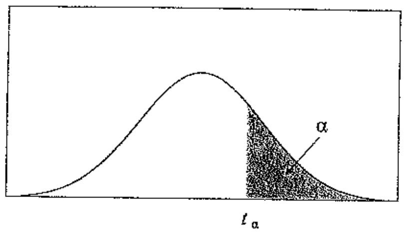
$P(0 < Z < z) = \alpha$



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0,4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.49865	0.49869	0.49874	0.49878	0.49882	0.49886	0.49889	0.49893	0.49897	0.49900
3.1	0.49903	0.49906	0.49910	0.49913	0.49916	0.49918	0.49921	0.49924	0.49926	0.49929
3.2	0.49931	0.49934	0.49936	0.49938	0.49940	0.49942	0.49944	0.49946	0.49948	0.49950
3.3	0.49952	0.49953	0.49955	0.49967	0.49958	0.49960	0.49961	0.49962	0.49964	0.49965
3.4	0.49966	0.49968	0.49969	0.49970	0.49971	0.49972	0.49973	0.49974	0.49975	0.49976
3.5	0.49977	0.49978	0.49978	0.49979	0.49980	0.49981	0.49981	0.49982	0.49983	0.49983
3.6	0.49984	0.49985	0.49985	0.49986	0.49986	0.49987	0.49987	0.49988	0.49988	0.49989

t 分配臨界值表

$P(t > t_{\alpha}) = \alpha$



d.f.	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	d.f.
1	3.078	6.314	12.706	31.821	63.656	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
30	1.310	1.697	2.042	2.457	2.750	30
31	1.310	1.696	2.040	2.453	2.774	31
32	1.309	1.694	2.037	2.449	2.739	32
33	1.308	1.692	2.035	2.445	2.733	33
34	1.307	1.691	2.032	2.441	2.728	34
35	1.306	1.690	2.030	2.438	2.724	35
36	1.306	1.688	2.028	2.435	2.720	36
37	1.305	1.687	2.026	2.431	2.715	37
38	1.304	1.686	2.024	2.429	2.712	38
39	1.304	1.685	2.023	2.426	2.708	39
40	1.303	1.684	2.021	2.423	2.705	40