

請勿在本試題紙上作答，否則不予計分

Do not write your answers here.

Please leave the space and summarize your answer in the beginning of your answer sheet according to the format shown as follows.

1	(1)	(2)
2	(1)	(2)
3	(1)	(2)
	(3)	(4)
4	(1)	(2)
	(3)	(4)
5	(1)	(2)
6	(1)	(2)
	(3)	(4)
	(5)	(6)

1. (10%) Some researchers at the National Cheng Kung University have designed the circuit for generating the signals. Suppose the circuit signals X is a random variable bested described by a uniform probability distribution with range $(4, 10)$.

- (1) (5%) Find mean and standard deviation of the circuit signals.
- (2) (5%) Find $P(\mu - \sigma \leq X \leq \mu + \sigma)$

2. (10%) Suppose X is a random variable described by a standard normal distribution.

- (1) (5%) Find $P(\mu - \sigma \leq X \leq \mu + \sigma)$
- (2) (5%) Find $P(-1.282 \leq X \leq 1.282)$

3. (20%) Are all employees equally likely to have accidents? A study conducted to address these questions for a particular manufacturing company. A sample of 100 is taken.

KIND OF ACCIDENT

	Burn	cut
Age Under25	46	24
Age 25 and over	14	16

The manager wants to know if there is evidence to show the proportions of employees in the two age groups are different in the two kinds of accident.

Write out

- (1) (5%) the null and alternative hypothesis.
- (2) (5%) test statistics.
- (3) (5%) decision and conclusion at $\alpha = 0.05$.
- (4) (5%) decision and conclusion at $\alpha = 0.1$.

4. (20%) At 2011, Department of Business Administration, NCKU, surveyed 2,000 Web users and asked them about their willingness to pay fees for access to web sites. Of these, 500 were definitely not willing to pay such fees.

- (1). (5%) Assume the 2,000 users were randomly selected. Write down the formula for the construction of a 95% confidence interval for the proportion definitely unwilling to pay fees.
- (2). (5%) Calculate the 95% confidence interval for the proportion definitely unwilling to pay fees by the formula in (1).
- (3). (5%) What is the probability that the population proportion falls into the interval you obtain in (2).

(背面仍有題目,請繼續作答)

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- (4). (5%) How large a sample size is necessary to estimate the proportion of interest to within 2% with 95% confidence?
5. (10%) A consulting firm takes mostly 3 kinds of projects. Over the last three years, the proportion of the projects is (20%, 40%, 40%) with working time (2, 4, 6) weeks, respectively.
- (1). (5%) What is the probability distribution for the average working time of 2 projects?
- (2). (5%) What is the expect average working time of 2 projects?
6. (30%) The table presents the quarterly sales index (the unit is 1000) for one brand of cell phone of a company.

YEAR	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
2008	260	398	252	260
2009	256	429	376	256
2010	228	496	425	228
2011	248	576	426	248

The model considered here is

$$\text{Sales} = b_0 + b_1 * T + b_2 * Q_1 + b_3 * Q_2 + b_4 * Q_3 + \text{Error},$$

where T=1 for quarter 1 of year 2008 to T=16 for quarter 4 of year 2011;

Q1=1 if quarter 1, Q1=0 if quarter 2,3, or 4;

Q2=1 if quarter 2, Q2=0 if quarter 1,3, or 4;

Q3=1 if quarter 3, Q3=0 if quarter 1,2, or 4.

Use the SAS output below:

- (1). (5%) Evaluate the usefulness of the model by two statistics in the SAS output.
- (2). (5%) List the least squares estimates of model coefficients.
- (3). (5%) Give the test for the difference effect of Q1-Q4.
- (4). (5%) Give the estimate of the effect of Q2-Q1.
- (5). (5%) What are the typical assumptions about the random error components we need for the model?
- (6). (5%) Find the forecasts and 95% prediction intervals for the 2012 Q3 sales.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	157126	39282	16.37	0.0001
Error	11	26399	2399.93636		
Corrected Total	15	183526			

Root MSE	48.98915	R-Square	0.8562
Dependent Mean	335.12500	Adj R-Sq	0.8038
Coeff Var	14.61817		

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	182.75000	36.74186	4.97	0.0004
T	1	6.52500	2.73858	2.38	0.0363
Q1	1	19.57500	35.60149	0.55	0.5934
Q2	1	239.80000	35.07089	6.84	<.0001
Q3	1	128.27500	34.74864	3.69	0.0036

Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	95% CL Predict	Residual
1	260.0000	208.8500	29.4954	82.9907 334.7093	51.1500

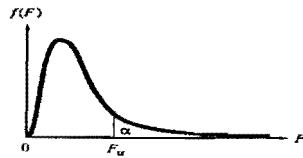
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2	398.0000	435.6000	29.4954	309.7407	561.4593	-37.6000
3	252.0000	330.6000	29.4954	204.7407	456.4593	-78.6000
4	260.0000	208.8500	29.4954	82.9907	334.7093	51.1500
5	256.0000	234.9500	25.0995	113.7974	356.1026	21.0500
6	429.0000	461.7000	25.0995	340.5474	582.8526	-32.7000
7	376.0000	356.7000	25.0995	235.5474	477.8526	19.3000
8	256.0000	234.9500	25.0995	113.7974	356.1026	21.0500
9	228.0000	261.0500	25.0995	139.8974	382.2026	-33.0500
10	496.0000	487.8000	25.0995	366.6474	608.9526	8.2000
11	425.0000	382.8000	25.0995	261.6474	503.9526	42.2000
12	228.0000	261.0500	25.0995	139.8974	382.2026	-33.0500
13	248.0000	287.1500	29.4954	161.2907	413.0093	-39.1500
14	576.0000	513.9000	29.4954	388.0407	639.7593	62.1000
15	426.0000	408.9000	29.4954	283.0407	534.7593	17.1000
16	248.0000	287.1500	29.4954	161.2907	413.0093	-39.1500
17	.	313.2500	36.7419	178.4695	448.0305	.
18	.	540.0000	36.7419	405.2195	674.7805	.
19	.	435.0000	36.7419	300.2195	569.7805	.
20	.	313.2500	36.7419	178.4695	448.0305	.

TABLE VIII Percentage Points of the F-distribution, $\alpha = .10$



ν_2	NUMERATOR DEGREES OF FREEDOM								
	1	2	3	4	5	6	7	8	9
1	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86
2	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38
3	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24
4	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94
5	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32
6	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96
7	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72
8	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56
9	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44
10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35
11	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27
12	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21
13	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16
14	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12
15	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09
16	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06
17	3.03	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03
18	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00
19	2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98
20	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96
21	2.96	2.57	2.36	2.23	2.14	2.08	2.02	1.98	1.95
22	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93
23	2.94	2.55	2.34	2.21	2.11	2.05	1.99	1.95	1.92
24	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91
25	2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89
26	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88
27	2.90	2.51	2.30	2.17	2.07	2.00	1.95	1.91	1.87
28	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87
29	2.89	2.50	2.28	2.15	2.05	1.99	1.93	1.89	1.86
30	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85
40	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79
60	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74
120	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68
∞	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63

Source: From M. Murrington and C. M. Thompson, "Tables of Percentage Points of the Inverted Beta (F) Distribution," *Biometrika*, 1943, 35, 73-88. Reproduced by permission of the *Biometrika* Trustees.

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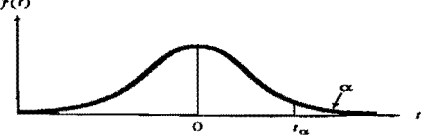
(背面仍有題目,請繼續作答)

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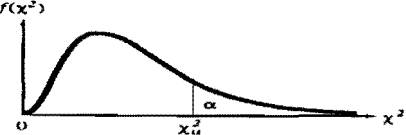
TABLE VI Critical Values of t



ν	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	$t_{.001}$	$t_{.0005}$
1	3.078	6.314	12.706	31.821	63.657	318.31	636.62
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

Source: This table is reproduced with the kind permission of the Trustees of Biometrika from E. S. Pearson and H. O. Hartley (eds.), *The Biometrika Tables for Statisticians*, Vol. 1, 3d ed., Biometrika, 1966.

TABLE VII Critical Values of χ^2



Degrees of Freedom	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$
1	.0000393	.0001571	.0009821	.0039321	.0157908
2	.0100251	.0201007	.0506356	.102587	.210720
3	.0717212	.114832	.215795	.351846	.584375
4	.206990	.297110	.484419	.710721	1.063623
5	.411740	.554300	.831211	1.145476	1.61031
6	.675727	.872085	1.237347	1.63539	2.20413
7	.989265	1.239043	1.68987	2.16735	2.83311
8	1.344419	1.646482	2.17973	2.73264	3.48954
9	1.734926	2.087912	2.70039	3.32511	4.16816
10	2.15585	2.55821	3.24697	3.94030	4.86518
11	2.60321	3.05347	3.81575	4.57481	5.57779
12	3.07382	3.57056	4.40379	5.22603	6.30380
13	3.56503	4.10691	5.00874	5.89186	7.04150
14	4.07468	4.66043	5.62872	6.57063	7.78953
15	4.60094	5.22935	6.26214	7.26094	8.54675
16	5.14224	5.81221	6.90766	7.96164	9.31223
17	5.69724	6.40776	7.56418	8.67176	10.0852
18	6.26481	7.01491	8.23075	9.39046	10.8649
19	6.84398	7.63273	8.90655	10.1170	11.6509
20	7.43386	8.26040	9.59083	10.8508	12.4426
21	8.03366	8.89720	10.28293	11.5913	13.2396
22	8.64272	9.54249	10.9823	12.3380	14.0415
23	9.26042	10.19567	11.6885	13.0905	14.8479
24	9.88623	10.8564	12.4011	13.8484	15.6587
25	10.5197	11.5240	13.1197	14.6114	16.4734
26	11.1603	12.1981	13.8439	15.3791	17.2919
27	11.8076	12.8786	14.5733	16.1513	18.1138
28	12.4613	13.5648	15.3079	16.9279	18.9392
29	13.1211	14.2565	16.0471	17.7083	19.7677
30	13.7867	14.9535	16.7908	18.4926	20.5992
40	20.7065	22.1643	24.4331	26.5093	29.0505
50	27.9907	29.7067	32.3574	34.7642	37.6886
60	35.5346	37.4848	40.4817	43.1879	46.4589
70	43.2752	45.4418	48.7576	51.7393	55.3290
80	51.1720	53.5400	57.1532	60.3915	64.2778
90	59.1963	61.7541	65.6466	69.1260	73.2912
100	67.3276	70.0648	74.2219	77.9295	82.3541

Source: From C. M. Thompson, "Tables of the Percentage Points of the χ^2 -Distribution," *Biometrika*, 1941, 32, 188-189. Reproduced by permission of the *Biometrika* Trustees.

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