

❖ 注意：共三大題組。請於答案卷依題號依序作答，並清楚標明題號。計算題請寫出計算過程。

一、 解釋名詞（每題 5 分，六題共 30 分）

1. Power of a statistical test (統計檢定力)
2. Central Limit Theorem (中央極限定理)
3. Statistical control (統計控制)
4. Interaction (統計中的互動效果)
5. Sampling distribution (抽樣分配)
6. Level of significance (顯著水準)

二、 計算與簡答題（60 分）

1. (每題 3 分，兩題共 6 分) 某品牌冰箱的壽命其分配約為常態分配，平均為 4.8 年，標準差為 1.3 年。
 - a) 若該產品的保固期為 2 年，請問所購買的冰箱在保固期內會因故障而需要更換的機率為多少？
 - b) 如果製造商只想讓所生產的冰箱只有 0.5% 的更換率，那麼應該把保固期重新設為多少年？
2. (4 分) 某家化學工廠被指控對當地的河川造成汙染。地方政府要求指控者對河川水質樣本的汙染指數進行統計檢定，以做為該項指控為真的證據。在此假設檢定的過程中，化學工廠會害怕此統計檢定中的哪一種錯誤呢(Type I or a Type II error)? 為什麼？
3. (10 分) Compare how effective two on-line dating websites (e-Harmony and Match.com) are as to helping their single customers find stable romantic partners (i.e. continuously date for at least 3 months long or marry). Of a sample of 341 e-Harmony online daters, 87 had found stable romantic partners within six months since registration; of a sample of 40 Match.com daters, 9 had found stable romantic partners. A researcher constructed a 99% confidence interval for the difference in population proportions. See the results attached below. Verify if these two online dating website are similarly effective. Please answer the following questions.

Test and CI for Two Proportions

Sample	X	N	Sample P
1	87	341	0.255132
2	9	40	0.225000

Difference = $p(1) - p(2)$

Estimate for difference: 0.0301320

99% CI for difference: (-0.150483, 0.021074)

- a) (2 分) Hypothesis testing is one or two tailed?
- b) (4 分) Write down your null and alternative hypotheses (以文字描述或是採符號表示皆可)。

H_0 : _____

H_1 : _____

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- c) (2分) Decision (Reject or fail to reject H_0 at the level of 0.1)?
d) (2分) Conclusion?
4. (16分) 居住於三個都市地區的皮膚癌患者中，我們隨機抽出一些樣本，樣本中個人被診斷出有皮膚癌時的年齡紀錄如下：

Maryland	LA	Miami
20	33	18
62	24	36
35	55	29
43	49	57
		27

請檢驗在顯著水準 $\alpha=0.05$ 時，皮膚癌平均診斷年齡是否因居住地的不同而有顯著的差異。

- 1) 請分別寫下此檢定的虛無與對立假設 (2分)
2) 請完成以下的 ANOVA 表，填入 A-F 空格內的數字 (12分)

Source of Variation	Sum of Squares	Degree of Freedom	Mean square	F
Between-group	SSB	(A)	(D)	(F)
Within-group	SSW	(B)	(E)	
Total	SST	(C)		

在答案卷中標示空格所代表的英文字母以及你所計算出來的答案。

- 3) 請討論你的統計檢定結果以及結論 (2分).
5. (每題3分，四題共12分) 坊間流傳古典音樂可以增進嬰兒腦部的發展，增進其空間感與創造力。有一位幼兒發展學家欲檢驗莫札特的樂曲是否確實對幼童神經發展有所助益，他隨機選取10位樣本孩童，並追蹤他們從幼兒時期到高中的表現。當受試者16歲的時候，這名幼兒發展學家對這10位受試者的智商進行測驗，然後將IQ分數與其嬰兒時期每年平均聆聽莫札特音樂時數 (music_hrs) 進行比較。以下是該名研究者針對樣本資料收集而來的數據進行迴歸分析所產生的統計報表。請根據報表的數據回答下列的問題：
- a) 請寫下根據樣本資料所配適而來的迴歸方程式。
b) 請透過詮釋迴歸斜率值，描述音樂對智商的影響，並判定在 $\alpha=0.01$ 時，音樂對智商是否具有顯著的影響?
c) 對於小時候每年平均聽10小時莫札特的樂曲的人來說，其青少年期的預期IQ為多少?
d) 請問該名研究者所建構的迴歸模型可以幫助我們解釋多少青少年智商的變異?

國立臺灣大學105學年度轉學生招生考試試題

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Source	SS	df	MS	Number of obs	=	10
Model	1105.36296	1	1105.36296	F(1, 8)	=	20.16
Residual	438.637038	8	54.8296298	Prob > F	=	0.0020
Total	1544	9	171.555556	R-squared	=	0.7159
				Adj R-squared	=	0.6804
				Root MSE	=	7.4047

IQ	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
music_hrs	.4269459	.0950885	4.49	0.002	.2076714	.6462204
_cons	88.93354	5.045429	17.63	0.000	77.29876	100.5683

6. (每題 3 分，四題共 12 分) A regression is used to estimate the effects of education and years of working experience on the annual salary: $\hat{Y} = \beta_0 + \beta_1 X + \beta_2 D + \beta_3 X \times D$, where Y is the annual salary of an employee (in thousands of dollars) and X denotes the years of experience. D is coded as 1 for college graduates and is coded as 0 for those graduating high school but not college. The product term (X×D) is the interaction term.

- What is the intercept for high school graduate?
- What is the difference in the intercept between college graduates and non-college graduates?
- What is the average salary for high school graduate with 10 years of experience?
- What is the difference in slope between college graduates and non-college graduates?

三、(每題 2 分，五題共 10 分) 請為以下所描述的五個問題從 A-D 中選出一個合適的統計分析/檢定方法

- Chi-square test
- OLS regression
- T/Z tests for differences in means, or the like
- ANOVA (F tests)

- Is there an effect of hours spent on homework on reading test performance among elementary school children?
- Are there differences in the proportion of residents who drive hybrid cars as their primary mode of transportation in Texas, California, and New York?
- Are there differences by rank (TA, lecturer, professor) or sex of instructor (male, female) in the average grade assigned to first year students in *Introduction to Sociology*?
- Is there an effect of time lapsed since immigration to the U.S. on earnings among U.S. immigrant workers once level of education is controlled?
- Are there differences in the proportion of Male and Female professors who watch Game of Thrones as their favorite TV show?

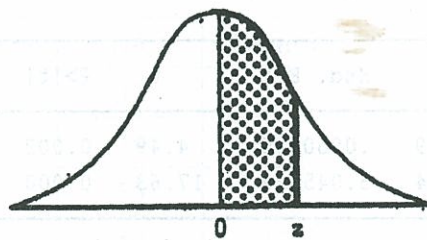
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Z Table

Area Under the Normal Curve



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

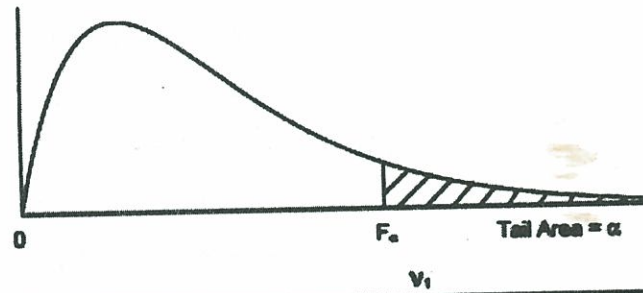
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國立臺灣大學105學年度轉學生招生考試試題

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Upper critical Values of the F-Distribution with (v_1, v_2) df



v_2	α	1	2	3	4	5	6	7	8	9
10	.10	3.20	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35
	.05	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
	.025	6.04	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78
	.01	10.0	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94
	.005	12.8	9.43	8.08	7.34	6.87	6.54	6.30	6.12	5.97
12	.10	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21
	.05	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
	.025	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44
	.01	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39
	.005	11.8	8.51	7.23	6.52	6.07	5.76	5.52	5.35	5.20
15	.10	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09
	.05	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
	.025	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12
	.01	8.88	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89
	.005	10.8	7.70	6.48	5.80	5.37	5.07	4.85	4.67	4.54
20	.10	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96
	.05	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
	.025	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84
	.01	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46
	.005	9.94	6.99	5.82	5.17	4.76	4.47	4.26	4.09	3.96
24	.10	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91
	.05	4.28	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
	.025	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70
	.01	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26
	.005	9.55	6.66	5.52	4.89	4.49	4.20	3.99	3.83	3.69
30	.10	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85
	.05	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
	.025	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.66	2.57
	.01	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07
	.005	9.18	6.35	5.24	4.62	4.23	3.95	3.74	3.58	3.45
60	.10	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74
	.05	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
	.025	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33
	.01	7.08	4.96	4.13	3.65	3.34	3.12	2.95	2.82	2.72
	.005	8.40	5.70	4.73	4.14	3.76	3.49	3.29	3.13	3.01
120	.10	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68
	.05	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96
	.025	5.15	3.80	3.23	2.90	2.67	2.52	2.39	2.30	2.22
	.01	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56
	.005	8.18	5.54	4.59	3.92	3.55	3.28	3.09	2.93	2.81
∞	.10	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63
	.05	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88
	.025	5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11
	.01	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41
	.005	7.88	5.30	4.28	3.72	3.35	3.09	2.90	2.74	2.62

試題隨卷繳回