

國立臺北大學 111 學年度碩士班一般入學考試試題

系(所)組別：企業管理學系甲組

科目：統計學

第1頁 共3頁

可 不可使用計算機

1. 三鶯公司將推出一種新品飲料，上市前想了解該產品的包裝(A)與定價(B)對消費者購買意圖的影響。行銷人員進行了一個二因子的實驗設計：A 因子有四種包裝；B 因子有三種定價，隨機指派 120 位受測者到各個因子的水準組合（每種組合有 10 位）。依據蒐集的資料進行二因子變異數分析（two-way ANOVA），結果如下：

變異來源	平方和	自由度	F 值
A	120	(a)	(e)
B	60	(b)	(f)
A×B	84	(c)	(g)
誤差	864	(d)	
總和	1128	119	

- (1) 請計算 a-g () 內的數值。(21%)
- (2) 95% 信賴水準下，如果 A×B 的效果不顯著，而 A 與 B 的 F 值都超過臨界值，請問該接著進行何種分析？(9%)
2. 某研究生建立線性迴歸模式為： $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$ ， β_0 、 β_1 、 β_2 分別是截距與解釋變數的係數， ε_i 是隨機誤差項， $i=1, 2, \dots, n$ ， n 為樣本大小。依此模式進行資料分析，假設結果滿足線性迴歸的基本假設， Y_i 的總變異量為 SST，模式的解釋力為 R^2 。該生想要檢視解釋變數是否有互動效果把 $X_1 X_2$ 的乘積項加入模式中，結果發現解釋力增加為 R^{2*} 。請問該生如何建構 F 統計值 (F-value) 檢定解釋力的增量 (即 $R^{2*} - R^2$) 是否顯著？(10%) 又該生想要評估解釋變數的影響程度是否不等，請問該生如何建構 F 統計值進行檢定？(10%)

* Short Answers. Please show steps in your answers. Answers without proper steps will be deemed incomplete.

3. (10%) In American football, teams take turns in offense and defense. Assume that the only way teams can score is through offense. In the overtime, the team that scores *first* wins the game and they keep playing until a winner comes through. There is no tie game. Suppose Team A takes the offense first against Team B, and the probability of scoring at offense is 50% for either of the teams. What is the winning probability for Team A when they play in the overtime? What is the winning probability of Team B?
4. (10%) When you get accepted by NTPU, you might wish to commute to the campus and live in downtown Taipei City. You will likely need to take the metro and transfer by bus to the school. Suppose the travel time for metro and bus are both normally distributed and independent from each other and it takes you exactly 10 minutes in total for all the walking.

	Bus	Metro
μ	20	12
σ	4	3

Suppose you need to show up in class at 9:10AM on campus, what is the probability for you to be late when you walk out of your door at 8:25AM?

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接背面

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5. (10%) Suppose out of the 250,000 people who came to Taiwan in the first half of 2021, 500 people were COVID-19 carriers. The PCR tests are able to correctly identify the COVID-19 carriers 90 out 100 times on average. On the other hand, PCR tests will show positive results for the non-carriers 5% of the times. How many false positives and false negatives are expected to be identified from the 250,000 people who entered Taiwan? Explain why CDC decided to impose the quarantine (isolation) measures on passengers from abroad even though they had been tested negative for the PCR tests back in 2021?
6. (20%) A manufacturing company produces electrical switches. To test the strength of the switches, robustness testing is carried out on 100 switches to determine how many times before the switch breaks down. The average of number of uses is 1.245 million times and the standard deviation is 0.3 million. The company would like to investigate whether or not the population mean of usage is more than 1.2 million times.
- A. At the 0.10 level of significance, is there evidence that the population mean of the number of usage is *more than* 1.2 million? Please form the null hypothesis and alternative hypothesis respectively before performing statistical tests.
- B. When the true population mean is 1.240 million and the level of significance is set as 0.05, what is the probability of making type I and type II errors respectively?

Square root of numbers:

Number	10	20	30	40	50	60
SQRT	3.16	4.47	5.48	6.32	7.07	7.75

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Z-Table

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998									
4.0	0.99997									
4.5	0.999997									
5.0	0.9999997									

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