國立中山大學100學年度碩士班招生考試試題

科目：統計學【資管系碩士班甲組】

單選題 （每題5分）：

1、 公園路的公共停車場，共有342個停車格。某天張阿妹計算當天共有171輛車停放，則數字「171」是：(a) 樣本空間 (b) 母體 (c) 期望值 (d) 觀察值 (e) 隨機變數

2、 五福路上有10家拉麵店，王立華決定每天選兩家吃拉麵，兩兩比較。這樣共需要吃幾天？ (a) 45 (b)90 (c) 5 (d) 60 (e) 9

3、 一箱橘子中，有15個好的和5個瑕疵品。顧客隨機抽取3顆，只要其中有一個瑕疵品，則可以八折價錢購買整箱。則顧客可以八折購買的機率是 (a) 0.3 (b) 0.4 (c) 0.46 (d) 0.54 (e) 0.6

4、 瓶裝水的製程設定依照常態分佈，標準差是3ml。經過品檢後確認有2%的成品低於450ml；則製程設定的期望值是 (a) 448 (b) 452 (c) 456 (d) 459 (e) 460

5、 西灣國中二年級甲、乙班各派20位學生，作大隊接力競賽；每人100公尺，共2000公尺。根據以下的跑步成績，何者是正確的解釋？($t_{0.05,38} = 1.686$ $F_{0.05,19,19} = 2.1682$)

	總時間	每位學生平均時間	標準差
甲班	320秒	16秒	1.8秒
乙班	300秒	15秒	1.2秒

(a) t檢定顯示，甲班同學跑得比乙班快 (b) t檢定顯示，乙班同學跑得比甲班快 (c) 甲班跑得最快的同學比乙班跑得最快的同學更快 (d) 統計檢定顯示，甲班的跑步時間變異數較乙班爲大 (e) 統計檢定顯示，甲班的跑步時間變異數與乙班沒有不同。

6、 早上交通的尖峰時間，孫大文上學所需的交通時間平均需要15分鐘；假設上學所需的交通時間是指數分配 (exponential distribution)。則孫大文可在15分鐘以內到達學校的機率是 (e = 2.7183) (a) 0.72 (b) 0.63 (c) 0.5 (d) 0.48 (e) 0.45

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7、 學校調查同學對於餐廳的滿意度，以簡單的「滿意」和「不滿意」的選項，作爲初步的意見基礎。過去的資料顯示，滿意的同學約佔 60%。若是這次希望調查的錯誤範圍在 4%之內，則至少需要詢問幾位同學？ (a) 450 (b)500 (c) 550 (d) 600 (e) 1068

計算題 （共 15 分）:

8、 顧客進入天下超商，「想起 AA 果汁的電視促銷廣告」(事件 A)的機率是 0.5，「購買 AA 果汁」（事件 J）的機率是 0.2，兩個事件的交集之機率爲 0.15

(a) 顧客想起 AA 果汁的電視促銷廣告後才購買 AA 果汁的機率？ （5 分）

(b) AA 果汁廠商另外在網路上推出不同的促銷廣告（事件 B），「顧客想起 AA 果汁的網路廣告」的機率是 0.6，事件 B 與事件 J 的交集是 0.2；哪一種廣告產生較好的購買效果？（10 分）

填充題(每小題 2 分)

9. The following descriptions discuss statistical inferences about the population standard deviation (σ). First of all, the point estimator for σ is the sample standard deviation, s, which is (1) biased, unbiased and has a complicated sampling distribution. Nonetheless, we can perform the inferences about σ by taking a large sample of data. It is known that when n is large, the estimator s will approximately follow the normal distribution with mean = σ, and variance = $\sigma^2/2(n-1)$. We then consider the hypothesis test about σ in the large sample case. If we feel that the current σ would be smaller than σ_0 obtained from past experience, we should set up the hypotheses as (2). The test statistic is (3) with the form (4) under H_0. With the significant level α specified, we eventually obtain the critical region as (5).

計算題 (本題 20分)

10. A candy maker produces mints that have a label weight of 21.4 grams. For quality assurance, n=16 mints were selected at random from the Wednesday morning shift, resulting in the statistics $\bar{x}$ =21.9 grams and s_x =0.21. On Wednesday afternoon m =13 mints were selected at random, yielding $\bar{y}$ =21.5 and s_y = 0.32

(1) Find the margin of sampling error in terms of the ratio ($\hat{\theta}/\theta$) at the 90% confidence level.

(2) Find the mean of the data as if both samples were pooled together to form a single sample.

(3) Find the standard deviation of the data as if both samples were pooled together to form a single sample.

(4) Use the results in (2) and (3) to test whether the average weight of mints is larger than what was claimed (α=0.05).

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計算題（本題20分）

11. Firms in fields with rapidly changing technologies often wish to measure themselves versus the competition. By doing so, they can judge whether they are ahead or behind in technological capabilities. A typical measure is to use patent citations. Within each patent document, an inventor must cite previous patents whose technology is incorporated into the new invention. Really valuable patents will probably be cited a lot by later patents. Patents with no value will be forgotten and will not be cited by later patents. Thus, if a company can determine the number of cites to its patents by following patents, and whether this number is above average or below average, it will have some idea of the technological worth of its patent portfolio.
The following data show sampling results from 8 U.S. firms, 8 Japanese firms, and 8 Germany firms where all firms are on the top 1000 patenting organizations in the U.S. Definitions of the terminology are as follows :

- **Number of Patents:** raw patent count.
- **Current Impact Index (CII):** indexed citation rating, >1 indicates a company's patents are cited more frequently than average, <1 indicates less frequently.
- **Technology Strength:** number of patents × CII

	Technology Strength (in thousands)								
U.S.	7.3	8.2	4.3	8.0	7.3	6.6	4.5	9.3	5.2
Japan	8.8	4.8	5.1	8.5	7.4	3.1	7.6	5.6	4.2
German	5.6	6.5	3.8	4.1	5.2	4.5	3.3	2.0	2.5

(1) Why is number of patents alone not used to measure the technology strength?

(2) Is the mean technology strength among the three countries significantly different or not ($\alpha=0.1$)?

(3) Check the normality of technology strength among the U.S. firms.

(4) If you represent a firm like IBM whose Technology Strength is 7.1, describe how you evaluate your patent standing if its pure competitions are U.S. firms.

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附件表格

Table 1: The F Distribution

Cumulative Probabilities = 0.9

Numerator Degree of Freedom

Denominator d.f.	6	7	8	9	10	11	12	13	14	15	16
6	3.055	3.014	2.983	2.958	2.937	2.920	2.905	2.892	2.881	2.871	2.863
7	2.827	2.785	2.752	2.725	2.703	2.684	2.668	2.654	2.643	2.632	2.623
8	2.668	2.624	2.589	2.561	2.538	2.519	2.502	2.488	2.475	2.464	2.455
9	2.551	2.505	2.469	2.440	2.416	2.396	2.379	2.364	2.351	2.340	2.329
10	2.461	2.414	2.377	2.347	2.323	2.302	2.284	2.269	2.255	2.244	2.233
11	2.389	2.342	2.304	2.274	2.248	2.227	2.209	2.193	2.179	2.167	2.156
12	2.331	2.283	2.245	2.214	2.188	2.166	2.147	2.131	2.117	2.105	2.094
13	2.283	2.234	2.195	2.164	2.138	2.116	2.097	2.080	2.066	2.053	2.042
14	2.243	2.193	2.154	2.122	2.095	2.073	2.054	2.037	2.022	2.010	1.998
15	2.208	2.158	2.119	2.086	2.059	2.037	2.017	2.000	1.985	1.972	1.961
16	2.178	2.128	2.088	2.055	2.028	2.005	1.985	1.968	1.953	1.940	1.928

Cumulative Probabilities = 0.95

Numerator Degree of Freedom

Denominator d.f.	6	7	8	9	10	11	12	13	14	15	16
6	4.284	4.207	4.147	4.099	4.060	4.027	4.000	3.976	3.956	3.938	3.922
7	3.866	3.787	3.726	3.677	3.637	3.603	3.575	3.550	3.529	3.511	3.494
8	3.581	3.500	3.438	3.388	3.347	3.313	3.284	3.259	3.237	3.218	3.202
9	3.374	3.293	3.230	3.179	3.137	3.102	3.073	3.048	3.025	3.006	2.989
10	3.217	3.135	3.072	3.020	2.978	2.943	2.913	2.887	2.865	2.845	2.828
11	3.095	3.012	2.948	2.896	2.854	2.818	2.788	2.761	2.739	2.719	2.701
12	2.996	2.913	2.849	2.796	2.753	2.717	2.687	2.660	2.637	2.617	2.599
13	2.915	2.832	2.767	2.714	2.671	2.635	2.604	2.577	2.554	2.533	2.515
14	2.848	2.764	2.699	2.646	2.602	2.565	2.534	2.507	2.484	2.463	2.445
15	2.790	2.707	2.641	2.588	2.544	2.507	2.475	2.448	2.424	2.403	2.385
16	2.741	2.657	2.591	2.538	2.494	2.456	2.425	2.397	2.373	2.352	2.333

Table 2: The Normal Distribution

Cumulative Probabilities								
0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
0.126	0.253	0.385	0.524	0.674	0.842	1.036	1.282	1.645