

考試科目	計算機概論	所別	資訊管理系 商管組/科技組	4/6/4/62	考試時間	>月>6日(日) 第一節
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I.
Answer Yes (O) / No (X) for the following descriptions: (30%)

1. 1. The idea of "Divide and Conquer" is to divide the problem into sub problems that can be solved independently, and conquer the results of sub problems.
2. The idea of "Dynamic Programming" is to define global optimum in terms of optimal sub problems. Sub problems may overlap. We can solve and store the results of sub problems bottom-up to accelerate the computation.
3. In a binary search tree, any value in the left subtree of a node is less than any value in the right subtree of the same node.
4. An inorder traversal of a binary search tree visits the keys of nodes in an increasing order.
5. In a graph, two vertices in a graph are adjacent if there exists an edge having these two vertices as its end vertices, and two edges in a graph are parallel if they have different end vertices.
6. The sum of the degree of all vertices in a graph is equal to the number of edges in the graph.
7. Removing the tail in a singly linked list (with the pointers of head and tail) takes $O(1)$ time.
8. A skip list contains a series of lists where each list is a subsequence of the previous one.
9. In a skip list with n entries, the expected search, insertion and deletion time is $O(n)$.
10. Checking whether an edge is incident to a vertex can be done in $O(1)$ time in an adjacency-matrix graph.
11. Removing a vertex in an adjacency-matrix graph takes $O(n^2)$ time, where n is the number of vertices in the graph.
12. The height of a binary tree is the maximum depth of its node, where the depth of a node in a tree is the number of its descendants.
13. An AVL tree is a binary search tree where for every internal node the heights of its children are the

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<p>same.</p> <p>14. In a splay tree, splaying a node means moving the node to a leaf.</p> <p>15. A Map is an ADT where multiple entries with the same key are allowed.</p> <p>16. While using an unsorted list to implement a Map, get(k) (find the entry with the key k) takes $O(1)$ time.</p> <p>17. While using an unsorted list to implement a map, remove(k) (remove the entry with the key k) takes $O(n)$ time.</p> <p>18. A hash function maps a key to integers in a fixed interval, e.g., $[0, N-1]$ for a hash table associated with an Array of size N.</p> <p>19. Hashing is more efficient when the load factor (the number of stored elements / the size of the Array) is higher.</p> <p>20. Linear probing handles collisions on a hash table by letting each cell of in the table point to a linked list, while separate chaining handles collisions by finding the nearest available cell.</p> <p>21. An array-based stack takes $O(n)$ time in average for push(k) using the constant incremental strategy when it is full.</p> <p>22. The basic unit in Java is an object whose type is defined by a class.</p> <p>23. In Java, "Overloading" means that we redefine a method in the subclass, while "Overriding" means that we define the same method in the same class with different signatures.</p> <p>24. An interface can inherit multiple interfaces; a class can inherit only a single class.</p> <p>25. A class can implement many interfaces as long as it implements all the methods of each interface.</p> <p>26. Using brute-force pattern matching (forward), we need 18 comparisons to find a match "aab" in "aaaaaab".</p>						

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27. A heap storing n values has height $O(n)$, and methods $\text{insert}(k)$ and $\text{removeMin}()$ take $O(n)$ time.
28. A heap-order specifies the relations between sibling nodes, e.g., the value stored in the left child is greater than the value stored in the right child.
29. A min heap has the minimal key stored in the last node (the right most node of the bottom layer).
30. Heap-sort is a quadratic sorting algorithm, i.e., it takes $O(n^2)$ time for sorting n elements.

II.
Answer the following questions:

1. Evaluating an arithmetic expression:

1.1 (10%) Represent the expression $3 * 5 + 2 > 15 - 4 * 3 + 5$ using a binary tree. (An internal node stores an operator, e.g., $*$, $+$, and an external node stores a value, e.g., 3, 5.)

1.2 (15%) Write the pseudo code to evaluate such kind of an expression.

Algorithm: evaluateExpression (T, v)

Input: A binary tree T and a node v in T

Output: the value of v

2. Sorting n elements:

2.1 (10%) Given n integers, describe a sorting algorithm that has $O(n)$ complexity.

2.2 (15%) Run an in-place quick sort on the following array. Show the result of each iteration by choosing the first element as a pivot.

[15, 3, 12, 7, 35, 28, 16, 9, 19, 20, 5, 32, 18]

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3. Finding the minimal string combination in the alphabetic order:

Given a set of n strings, $S = \{s_1, s_2, \dots, s_n\}$, we say that a string s is a combination of S if s is equal to a combination of all strings in S (in any order). We say that a string s is the minimal combination of S , if s has the minimal alphabetical order among all the combinations of S .

For examples:

(1) $S = \{bb, aa, cc\}$, the minimal combination is "aabbcc."

(2) $S = \{ab, abc\}$, the minimal combination is "ababc."

(3) $S = \{cae, abc, cd\}$, the minimal combination is "abccaecd."

3.1 (5%) Please describe a greedy algorithm with the aim to find the minimal combination of S .

3.2 (5%) Show an example to illustrate how it works.

3.3 (10%) Show a counter example that the algorithm fails.

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1. 新興資訊科技幫助企業提供客戶許多創新服務，例如：客製化商品服務，隨需服務，及時影音互動服務，適地服務，協同生產服務等等；這些創新服務可以為企業帶來哪些競爭優勢與管理挑戰？試分別舉出兩項（一項為服務業，一項為製造業）企業應用資訊科技提出創新的客戶服務案例，分析這些不同的創新服務為企業帶來的競爭優勢與管理挑戰。(30分)

2. 金融業透過整併期望建立更優質的企業資源與能力，試以銀行併購專案為例，討論在資訊架構，IT 治理與 IT 管理，以及 IT 服務上有哪些重要事項需要規劃與執行。(30分)

3. 如果你被邀請為來台新創國際時尚品牌 ZARA 設計電子商務平台，你計畫在流程與組織，及技術應用上如何進行？(30分)

4. 在台東的一群創意設計工作者邀請你一起討論如何可以利用社群平台與智慧型手機讓世界認識並且拜訪台灣東海岸，你會如何建議呢？(10分)

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共八題(每題各佔 10 到 16 分)：

1. (15%) 下表為某年度大學指定考試，國文、英文、物理三科成績的統計表：

	最小值	12%	25%	50%	平均數	75%	88%	最大值	標準差
國文	0	27	34	44	43.56	53	60	93	13.88
英文	0	8	16	34	36.68	56	69	98	23.88
物理	0	6	12	23	28.75	41	57	100	21.50

- (a) 初步資料分析包括集中趨勢 (Measures of Location, 例如：平均數) 與分散趨勢 (Measures of Variability 例如：變異數)。除了平均數及變異數 (或是標準差) 外，分別舉出集中趨勢與分散趨勢各三個可能測量方式。
- (b) 試以上述的分散趨勢數值代入大學指定考試，描述這三科成績的分佈特性。(例如：哪一科成績比較接近常態分配，為什麼?)
2. (10%) 抽樣(Sampling)在統計扮演重要的角色：
- (a) 何謂「機率」抽樣(Probability Sampling)方法，舉出三個常見機率抽樣方法？
- (b) 舉出三個常見的「非機率」抽樣方法，並(舉例)說明為什麼非機率抽樣比較容易得到偏差的結果。
3. (10%) 有一首歌「姊姊妹妹站起來」，其中有一句歌詞如下：「十個男人七個傻、八個呆、九個壞。」如果歌詞敘述屬實，計算以下機率：
- (a) 假設「傻」、「呆」、「壞」三者獨立，計算兼具三者的男人比例；
- (b) 未給定任何假設，又呆又壞的男人中最多、最少各是多少；
- (c) 如果傻的男人中有 80% 也是呆的，試求不傻也不呆的男人比例。
4. (10%) 若成年男子的身高為常態分配，平均 172 公分、變異數 $36(\text{公分})^2$ ：
- (a) 計算任意抽出一名成年男子，他的身高超過 180 公分的機率；
- (b) 計算隨機抽出 10 名成年男子，平均身高超過 180 公分的機率；
- (c) 計算隨機抽出 100 名成年男子，平均身高超過 180 公分的機率。

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5. (15%) 考慮以下的假設檢定： $H_0: p \leq 0.8$ vs. $H_a: p > 0.8$ ，其中 p 是全國國民中具有某種特質的人口比例。隨機從全國抽出 400 位受訪者，發現具有該項特質的樣本比例為 0.853：
- 給定顯著水準 $\alpha = 0.05$ ，拒絕上述假設檢定 (H_0) 的臨界值為何？
 - 根據樣本資料計算統計量 Z ，你/妳的結論為何？
 - 計算檢定的 p 值 (p -value)；
 - 若真實的比例值為 ($p = 0.9$)，計算可能的型二誤差 (Type-II Error)。
6. (16%) 某商品的每日銷售量 (y) 與單價 (x) 間存在線性關係，以下為蒐集十天資料計算的結果： $\sum x = 28.9$, $\sum x^2 = 87.09$, $\sum y = 355$, $\sum y^2 = 12987$, $\sum xy = 1059.7$
- 以最小平方方法 (Least Squares) 求出迴歸方程式的係數；
 - 計算判定係數 (Coefficient of Determination)，並以此說明迴歸方程式的強度；
 - 迴歸方程式中的斜率顯著嗎？(顯著水準 $\alpha = 0.05$)
 - 以變異數分析 (Analysis of Variance) 的模式完成下表：

Source	SS	d.f.	MS	F
Regression		1		
Error		8		
Total		9		

7. (12%) 下表為隨機抽出某壽險公司四位銷售人員的業績 (連續五個月保單張數)：

甲營業員	乙營業員	丙營業員	丁營業員
16	17	12	17
14	15	12	11
15	16	8	14
19	13	14	16
16	19	14	17

- 試在 $\alpha = 0.05$ 下，檢定不同營業員的成績是否相同。
- 上述檢定需要什麼假設條件，如果假設條件不成立，可以使用哪些分析方法代替？

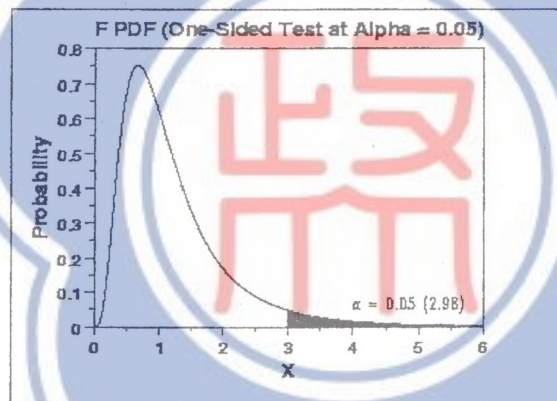
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8. (12%) 便利商店販售某廠牌的飲料，該飲料在架上平均停留時間據信服從常態分配。某日隨機抽出 30 瓶該廠牌的飲料，紀錄停留在架上的時間，想要探討停留時間是否服從常態分配：(樣本平均數及標準差分別為 23.07 及 4.29)

15	17	19	20	20	20	21	21	21	21
21	21	21	22	22	22	22	22	22	22
24	24	25	25	27	29	30	31	32	33

- (a) 列出虛無假設、對立假設：
- (b) 計算適合度檢定(Goodness-of-fit Test)的統計量；
- (c) 若顯著水準為 99%，驗證上述資料是否服從常態分配。

F 分配機率圖



df2/df1	1	2	3	4	5	6	7	8	9	10
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.1	4.06
8	5.32	4.46	4.07	3.84	3.69	3.58	3.5	3.44	3.39	3.35
10	4.96	4.1	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
12	4.75	3.89	3.49	3.26	3.11	3	2.91	2.85	2.8	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.6	3.74	3.34	3.11	2.96	2.85	2.76	2.7	2.65	2.6
15	4.54	3.68	3.29	3.06	2.9	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
20	4.35	3.49	3.1	2.87	2.71	2.6	2.51	2.45	2.39	2.35

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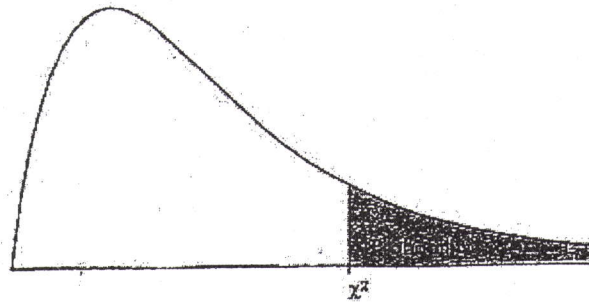


TABLE G: χ^2 CRITICAL VALUES

df	Tail probability <i>p</i>										
	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001
1	1.32	1.64	2.07	2.71	3.84	5.02	5.41	6.63	7.88	9.14	10.83
2	2.77	3.22	3.79	4.61	5.99	7.38	7.82	9.21	10.60	11.98	13.82
3	4.11	4.64	5.32	6.25	7.81	9.35	9.84	11.34	12.84	14.32	16.27
4	5.39	5.99	6.74	7.78	9.49	11.14	11.67	13.28	14.86	16.42	18.47
5	6.63	7.29	8.12	9.24	11.07	12.83	13.39	15.09	16.75	18.39	20.51
6	7.84	8.56	9.45	10.64	12.59	14.45	15.03	16.81	18.55	20.25	22.46
7	9.04	9.80	10.75	12.02	14.07	16.01	16.62	18.48	20.28	22.04	24.32
8	10.22	11.03	12.03	13.36	15.51	17.53	18.17	20.09	21.95	23.77	26.12
9	11.39	12.24	13.29	14.68	16.92	19.02	19.68	21.67	23.59	25.46	27.88
10	12.55	13.44	14.53	15.99	18.31	20.48	21.16	23.21	25.19	27.11	29.59
11	13.70	14.63	15.77	17.28	19.68	21.92	22.62	24.72	26.76	28.73	31.26
12	14.85	15.81	16.99	18.55	21.03	23.34	24.05	26.22	28.30	30.32	32.91
13	15.98	16.98	18.20	19.81	22.36	24.74	25.47	27.69	29.82	31.88	34.53
14	17.12	18.15	19.41	21.06	23.68	26.12	26.87	29.14	31.32	33.43	36.12
15	18.25	19.31	20.60	22.31	25.00	27.49	28.26	30.58	32.80	34.95	37.70
16	19.37	20.47	21.79	23.54	26.30	28.85	29.63	32.00	34.27	36.46	39.25
17	20.49	21.61	22.98	24.77	27.59	30.19	31.00	33.41	35.72	37.95	40.79
18	21.60	22.76	24.16	25.99	28.87	31.53	32.35	34.81	37.16	39.42	42.31
19	22.72	23.90	25.33	27.20	30.14	32.85	33.69	36.19	38.58	40.88	43.82
20	23.83	25.04	26.50	28.41	31.41	34.17	35.02	37.57	40.00	42.34	45.31
21	24.93	26.17	27.66	29.62	32.67	35.48	36.34	38.93	41.40	43.78	46.80
22	26.04	27.30	28.82	30.81	33.92	36.78	37.66	40.29	42.80	45.20	48.27
23	27.14	28.43	29.98	32.01	35.17	38.08	38.97	41.64	44.18	46.62	49.73
24	28.24	29.55	31.13	33.20	36.42	39.36	40.27	42.98	45.56	48.03	51.18
25	29.34	30.68	32.28	34.38	37.65	40.65	41.57	44.31	46.93	49.44	52.62
26	30.43	31.79	33.43	35.56	38.89	41.92	42.86	45.64	48.29	50.83	54.05
27	31.53	32.91	34.57	36.74	40.11	43.19	44.14	46.96	49.64	52.22	55.48
28	32.62	34.03	35.71	37.92	41.34	44.46	45.42	48.28	50.99	53.59	56.89
29	33.71	35.14	36.85	39.09	42.56	45.72	46.69	49.59	52.34	54.97	58.30
30	34.80	36.25	37.99	40.26	43.77	46.98	47.96	50.89	53.67	56.33	59.70
40	45.62	47.27	49.24	51.81	55.76	59.34	60.44	63.69	66.77	69.70	73.40
50	56.33	58.16	60.35	63.17	67.50	71.42	72.61	76.15	79.49	82.66	86.66
60	66.98	68.97	71.34	74.40	79.08	83.30	84.58	88.38	91.95	95.34	99.61
80	88.13	90.41	93.11	96.58	101.9	106.6	108.1	112.3	116.3	120.1	124.8
100	109.1	111.7	114.7	118.5	124.3	129.6	131.1	135.8	140.2	144.3	149.4

備註 試題隨卷繳交

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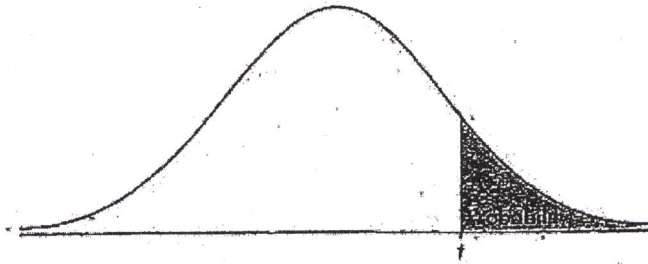


TABLE B: t-DISTRIBUTION CRITICAL VALUES

df	Tail probability p											
	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	.685	.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	.684	.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	.684	.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	.683	.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	.683	.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	.683	.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	.681	.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	.679	.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	.679	.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	.678	.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	.677	.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	.675	.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	.674	.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
Confidence level C												

備註 試題隨卷繳交