國立中山大學100學年度碩士班招生考試試題

科目：計算機概論【資管系碩士班甲組】

選擇題（每題五分）請注意前 7 題是單選題，後 6 題爲複選題。

1. (single choice) Given a list of input data: 15, 12, 9, 22, 18, 43, 2, and 38. A binary search tree is constructed based on the above input. Using binary search, how many comparisons you need to get the answer when searching for 38? (A) 2 (B) 3 (C) 4 (D) 5 (E) None of the above.

2. (single choice) Which of the following data structures is suitable for handling recursive calls? (A) tree (B) queue (C) array (D) stack.

3. (single choice) An $m \times m$ matrix denotes the social relationship among m persons. John is one of them. We can find John's friends from the matrix. A group of persons is in the same social circle if they all know each other. For example, John knows three persons, A, B, and C. The group, John, A, B, and C, is in the same social circle because they all know each other. What is the time complexity of finding John's social circle? (A) $O(m)$ (B) $O(m^2)$ (C) $O(m^3)$ (D) None of the above.

4. (single choice) Which of the following statements is **NOT** true?
   (A) Multiprogramming means that more than one program are ready to be executed at the same time.
   (B) Multiprogramming can improve CPU utilization.
   (C) Multiprocessing means that more than one processor can execute programs in parallel.
   (D) Multiprocessing is able to reduce the CPU time for each process.

5. (single choice) Which of the following I/O device is not "interrupt" based? (A) Keyboard (B) Monitor Display (C) Ethernet LAN card (D) None of the above.

6. (single choice) What is the syntax of creating a database table?
   (A) OPEN DATABASE [table_name] (.....)
   (B) CREATE TABLE [database_name] (.....)
   (C) OPEN TABLE [database_name] (.....)
   (D) CREATE DATABASE [table_name] (.....)

7. (single choice) Given a list, do the following: (Step 1) Find an element S from the list. Split the list into two and exchange elements such that all the elements in the first one are smaller than or equal to S and those in the second one are greater than S. (Step 2) Repeat step 1 until the given list is sorted. What kind of sort is it?
   (A) Merge sort
   (B) Index sort
   (C) Quick sort
   (D) Insertion sort

8. (multiple choices) Which of the following statements is/are true?
   (A) In term of connection overhead, UDP has less overhead than TCP.
   (B) For large amount of data transmission, UDP is more efficient than TCP.
   (C) In an unreliable network, such as wireless network, TCP still can provide reliable transmission.

國立中山大學100學年度碩士班招生考試試題

科目：計算機概論【資管系碩士班甲組】

(D) None of the above is true.

9. (multiple choices) Which of the following statements is/are true?
   (A) In a LAN (Local Area Network) environment, message is sent in broadcast mode, but only those nodes that have been addressed in the message will receive it.
   (B) ARP (Address Resolution Protocol) is used to resolve the mapping between IP address and host name.
   (C) CSMA (Carrier-Sense Multiple Access) is a transmission technique used in data link layer.
   (D) None of the above is true.

10. (multiple choices) Which of the following statements is/are true?
   (A) In relational database, each table is indexed by a key.
   (B) E-R model (Entity-Relationship Model) is a data abstract representation often used to design database.
   (C) E-R model is used to avoid data redundancy.
   (D) None of the above is true.

11. (multiple choices) Which of the following statements is/are true?
   (A) Cache is often used to speed up memory access time.
   (B) Web proxy is an extension of cache concept used to speed up web browsing.
   (C) Gateway connecting two networks is an extension of cache concept used to speed up network connection.
   (D) None of the above is true.

12. (multiple choices) Which of the following statements is/are true?
   (A) Client-server model is a communication approach where a server is always on waiting for client's requests.
   (B) (P2P) Peer-to-peer model is a communication approach where each peer can be a server or a client.
   (C) Socket can be used to implement P2P or client-server communication.
   (D) None of the above is true.

13. (multiple choices) Which of the following terms are belonged to Web Service?
   (A) UDDI (B) CDMA (C) WSDL (D) SOAP

應用題

14. (5%) Consider the design of a program for reporting the voting survey (投票民調) in a city. We wish to categorize the whole population into the following five groups: (i) Age 19 and under, (ii) Age between 20 to 29, (iii) Age between 30 to 39, (iv) Age between 40 to 49, and (v) Age 50 and above. For each group, we further divide the people into Male and Female subgroups. We have four candidates, Alex, Bob, Carol, and Dennis, in this election. Please answer the following questions:
   (A) You are asked to use a table to show the voting survey results. Please draw a table to illustrate how to report the results of voting survey.
   (B) Your program needs to be able to (1) add a new candidate to the table, and (2) given a [age, sex] group, report the total number of votes for any candidate, and (3) given a candidate, report the total number of votes for this candidate. Which of the following data structures is the best for this program: (a) stack, (b) queue,

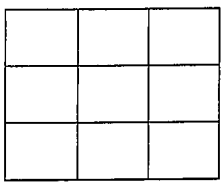
國立中山大學100學年度碩士班招生考試試題

科目：計算機概論【資管系碩士班甲組】

(c) array, or (d) tree? Justify your answer. (Note that: no justification, no points.)

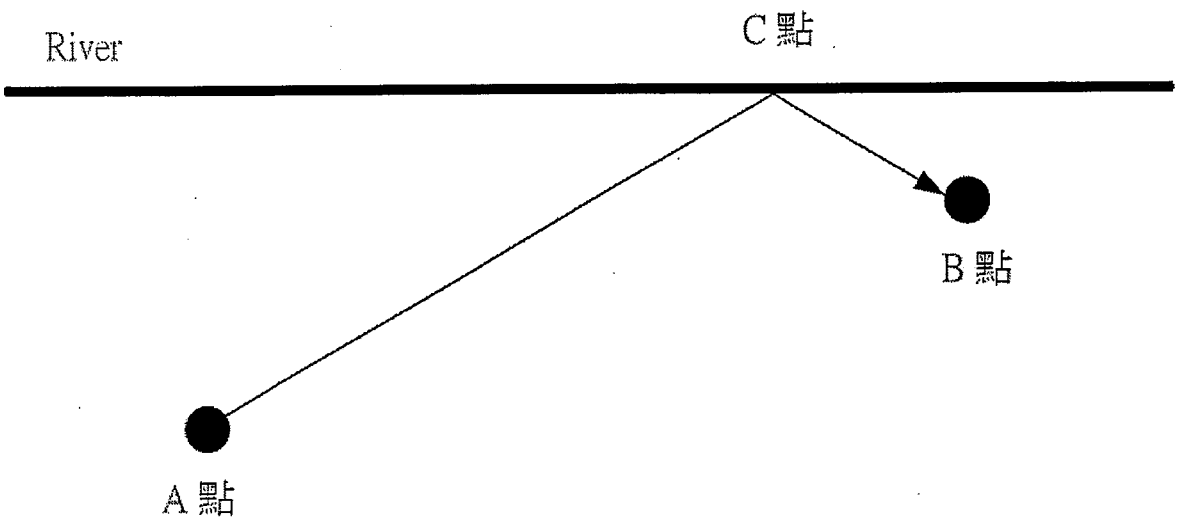
15. (5%) 請寫出 a+b*c/d-e 式子的 postfix 。

16. (5%) 請將 1，2，3，4，5，6，7，8，9 等數目分別填入 3X3 矩陣內（如下圖），使每行、每列、斜對角的三個數目的加總都相等。



17. (10%) 軟體架構是當今資訊世界最熱門題材之一。
(A) 請簡略地說明什麼是軟體架構(Software Architecture)?
(B) 請簡略地說明什麼是 Architecture Framework(AF)?

18. (10%) 下圖中有一條河(River)，離河有些距離處有 A 點和 B 點兩個地方。張三從 A 點開始，提著水桶走到河的 C 點處裝滿水後，再走到 B 點。假設 AC 代表 A 點到 C 點的直線路程，CB 代表 C 點到 B 點的直線路程，則張三總共走了 AC + CB 的路程）。



(A) 請問要如何定出 C 點處，如此 AC + CB 的路程將是最短的?
(B) 請 Prove 你定出的 C 點處是會讓 AC + CB 的路程最短的。

國立中山大學100學年度碩士班招生考試試題

科目：管理資訊系統【資管系碩士班甲組】

一、解釋名詞：（每題簡答字數不得超過 50 字，超過會扣分；每題四分）

1. 社群行銷
2. 顧客關係管理
3. 決策支援系統
4. 雲端運算
5. 長鞭效應

二、問答題（每題二十分）

1. Bill Gates 曾說過一句話：

   How you manage information determines whether you win or lose.

   請以電子商城及飯店業者爲例，根據相關理論有系統地說明有哪些方式（含資訊收集內容、彙整分析及應用與相關系統運用）可以提升競爭優勢？

2. 請說明要建置一個純粹的網路商店和爲一家已存在的商店建置網路商店，二者在經營規劃方面的考量有何主要差異？請依據每一規劃項目說明二者的考量是否有差異？如果有，又是什麼？

3. 請回答以下有關資料庫的問題：
   (1) 何謂關聯式資料庫 (Relational Database)？ (5%)
   (2) 請用實體關係圖 (Entity-Relationship Diagram) 來表示客戶、訂單、員工之間的關係。(5%)
   (3) 假設訂單表格有以下欄位：訂單編號、訂單日期、聯絡人、備註、客戶編號、員工編號，請畫出此資料表單，包括欄位名稱、欄位型態、鍵屬性 (何者是主鍵或外部鍵)。 (10%)

4. 請將下列摘要翻譯成中文。

   Over the last two decades, information systems (IS) research has primarily focused on people's conscious (intentional) behavior when trying to explain and predict IS usage. Consequently, almost no research has investigated the potential importance of subconscious (automatic) behaviors, also known as habits. This study represents a first step toward validating the idea that one can add explanatory power to a behavioral model such as Ajzen's [1985] theory of planned behavior (TPB) by including the habit construct. We conducted a two-stage questionnaire-based survey involving two different groups of students who had access to a sophisticated internet-based communication tool (IBCT). These data were used to test a behavioral model integrating theoretical constructs of TPB and a relevant subset of Triandis' [1980] behavioral framework. Our findings highlight the importance of considering *both* conscious (intentions) and subconscious (habits) factors in explaining usage behavior. Furthermore, we share our observations about antecedents of IBCT usage in the educational context. Implications for practice and research are discussed.

出處：M., Limayem, S. G. Hirt, Force of habit and information systems usage: Theory and initial validation, Journal of the Association for Information Systems 4 (1) (2003) 65-97.

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

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】

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).

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】

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 (α=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.

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】

附件考招

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

國立中山大學100學年度碩士班招生考試試題

科目：計算機概論【資管系碩士班乙組】

選擇題（每題五分）請注意前7題是單選題，後6題爲複選題。

1. (single choice) Given a list of input data: 15, 12, 9, 22, 18, 43, 2, and 38. A binary search tree is constructed based on the above input. Using binary search, how many comparisons you need to get the answer when searching for 38? (A) 2 (B) 3 (C) 4 (D) 5 (E) None of the above.

2. (single choice) Which of the following data structures is suitable for handling recursive calls? (A) tree (B) queue (C) array (D) stack.

3. (single choice) An $m \times m$ matrix denotes the social relationship among m persons. John is one of them. We can find John's friends from the matrix. A group of persons is in the same social circle if they all know each other. For example, John knows three persons, A, B, and C. The group, John, A, B, and C, is in the same social circle because they all know each other. What is the time complexity of finding John's social circle? (A) $O(m)$ (B) $O(m^2)$ (C) $O(m^3)$ (D) None of the above.

4. (single choice) Which of the following statements is **NOT** true?
   (A) Multiprogramming means that more than one program are ready to be executed at the same time.
   (B) Multiprogramming can improve CPU utilization.
   (C) Multiprocessing means that more than one processor can execute programs in parallel.
   (D) Multiprocessing is able to reduce the CPU time for each process.

5. (single choice) Which of the following I/O device is not "interrupt" based? (A) Keyboard (B) Monitor Display (C) Ethernet LAN card (D) None of the above.

6. (single choice) What is the syntax of creating a database table?
   (A) OPEN DATABASE [table_name] (.....)
   (B) CREATE TABLE [database_name] (.....)
   (C) OPEN TABLE [database_name] (.....)
   (D) CREATE DATABASE [table_name] (.....)

7. (single choice) Given a list, do the following: (Step 1) Find an element S from the list. Split the list into two and exchange elements such that all the elements in the first one are smaller than or equal to S and those in the second one are greater than S. (Step 2) Repeat step 1 until the given list is sorted. What kind of sort is it?
   (A) Merge sort
   (B) Index sort
   (C) Quick sort
   (D) Insertion sort

8. (multiple choices) Which of the following statements is/are true?
   (A) In term of connection overhead, UDP has less overhead than TCP.
   (B) For large amount of data transmission, UDP is more efficient than TCP.
   (C) In an unreliable network, such as wireless network, TCP still can provide reliable transmission.

國立中山大學100學年度碩士班招生考試試題

科目：計算機概論【資管系碩士班乙組】

(D) None of the above is true.

9. (multiple choices) Which of the following statements is/are true?
   (A) In a LAN (Local Area Network) environment, message is sent in broadcast mode, but only those nodes that have been addressed in the message will receive it.
   (B) ARP (Address Resolution Protocol) is used to resolve the mapping between IP address and host name.
   (C) CSMA (Carrier-Sense Multiple Access) is a transmission technique used in data link layer.
   (D) None of the above is true.

10. (multiple choices) Which of the following statements is/are true?
   (A) In relational database, each table is indexed by a key.
   (B) E-R model (Entity-Relationship Model) is a data abstract representation often used to design database.
   (C) E-R model is used to avoid data redundancy.
   (D) None of the above is true.

11. (multiple choices) Which of the following statements is/are true?
   (A) Cache is often used to speed up memory access time.
   (B) Web proxy is an extension of cache concept used to speed up web browsing.
   (C) Gateway connecting two networks is an extension of cache concept used to speed up network connection.
   (D) None of the above is true.

12. (multiple choices) Which of the following statements is/are true?
   (A) Client-server model is a communication approach where a server is always on waiting for client's requests.
   (B) (P2P) Peer-to-peer model is a communication approach where each peer can be a server or a client.
   (C) Socket can be used to implement P2P or client-server communication.
   (D) None of the above is true.

13. (multiple choices) Which of the following terms are belonged to Web Service?
   (A) UDDI (B) CDMA (C) WSDL (D) SOAP

應用題

14. (5%) Consider the design of a program for reporting the voting survey (投票民調) in a city. We wish to categorize the whole population into the following five groups: (i) Age 19 and under, (ii) Age between 20 to 29, (iii) Age between 30 to 39, (iv) Age between 40 to 49, and (v) Age 50 and above. For each group, we further divide the people into Male and Female subgroups. We have four candidates, Alex, Bob, Carol, and Dennis, in this election. Please answer the following questions:
   (A) You are asked to use a table to show the voting survey results. Please draw a table to illustrate how to report the results of voting survey.
   (B) Your program needs to be able to (1) add a new candidate to the table, and (2) given a [age, sex] group, report the total number of votes for any candidate, and (3) given a candidate, report the total number of votes for this candidate. Which of the following data structures is the best for this program: (a) stack, (b) queue,

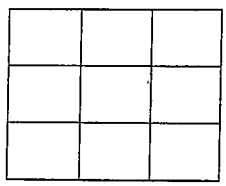
國立中山大學100學年度碩士班招生考試試題

科目：計算機概論【資管系碩士班乙組】

(c) array, or (d) tree? Justify your answer. (Note that: no justification, no points.)

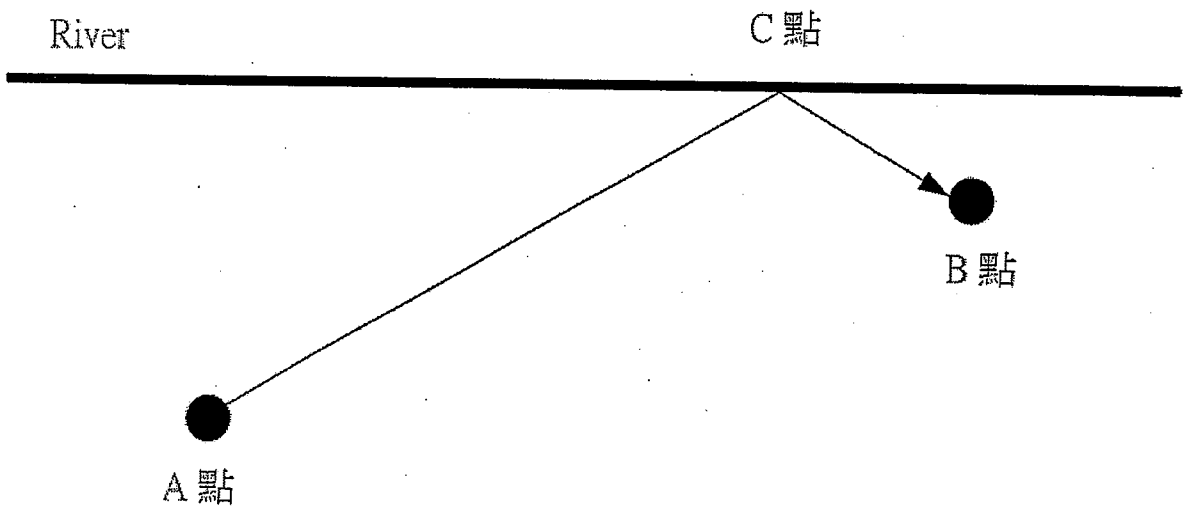
15. (5%) 請寫出 a+b*c/d−e 式子的 postfix 。

16. (5%) 請將 1，2，3，4，5，6，7，8，9 等數目分別填入 3X3 矩陣內（如下圖），使每行、每列、斜對角的三個數目的加總都相等。



17. (10%) 軟體架構是當今資訊世界最熱門題材之一。
(A) 請簡略地說明什麼是軟體架構(Software Architecture)?
(B) 請簡略地說明什麼是 Architecture Framework(AF)?

18. (10%) 下圖中有一條河(River)，離河有些距離處有 A 點和 B 點兩個地方。張三從 A 點開始，提著水桶走到河的 C 點處裝滿水後，再走到 B 點。假設 AC 代表 A 點到 C 點的直線路程，CB 代表 C 點到 B 點的直線路程，則張三總共走了 AC + CB 的路程）。



(A) 請問要如何定出 C 點處，如此 AC + CB 的路程將是最短的?
(B) 請 Prove 你定出的 C 點處是會讓 AC + CB 的路程最短的。

國立中山大學100學年度碩士班招生考試試題

科目：資料結構【資管系碩士班乙組】

1. (10%) Order the following functions by growth rate (in non-decreasing order): n , $n^{1.3}$, n^2 , $n \log n$, $n \log(\log n)$, $n(\log n)^2$, $n \log(n^2)$, $2/n$, 2^n, $2^{n/2}$, 100 , n^3 , 1.2^n

2. (15%)請說明底下的程式在做什麼？另外，請分析它的running time complexity。

```
1 for j ← 2 to length[A]
2     do key ← A[j]
3     i ← j - 1
4     while i > 0 and A[i] > key
5           do A[i+1] ← A[i]
6           i ← i - 1
7     A[i+1] ← key
```

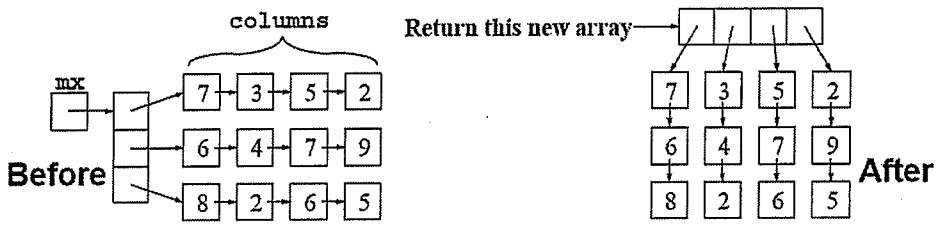
3. (15%) Let X[1..*n*] and Y [1..*n*] be two arrays, each containing *n* numbers already in sorted order. Give an O(lg *n*)-time algorithm to find the median of all 2*n* elements in arrays X and Y.

4. (15%) A *d*-ary heap is like a binary heap, but (with one possible exception) each non-leaf node has *d* children instead of 2 children.
   (a) How would you represent a *d*-ary heap in an array?
   (b) What is the height of a *d*-ary heap of *n* elements in terms of *n* and *d*?
   (c) Assume the heap operations are only BUILD-HEAP, EXTRACT-MAX, HEAP-INSERT. Now Dr. D claimed that 3-ary heaps are better (faster) than binary heaps because they need less comparison. Check whether the claim is right or wrong and explain your answer.

5. (15%) Write a method called transpose that performs a matrix transpose in the SListNode class below. The input parameter mx is an array of singly-linked lists, each representing a row of a matrix. (i.e. mx is a two dimensional array, except it's an array of lists instead of an array of arrays). The input parameter columns is the length of every linked list (no error checking required). Your job is to return an array of singly-linked lists, each representing a **column** of the same matrix. Here's a picture of what you should do:

國立中山大學100學年度碩士班招生考試試題

科目：資料結構【資管系碩士班乙組】



6. (15%) Write a search-based procedure to count the number of internal nodes in a binary tree.

7. For a directed graph G = (V, A), V = {1, 2, 3, 4, 5, 6}, A = {(1, 2), (2, 3), (3, 4), (4, 5), (1, 5), (2, 4), (2, 6), (1, 6), (4, 1, (5, 6)}, and each pair (i, j) in A describes an arc from node i to node j.
   (a) Use adjacency matrix and adjacency list to represent the graph. (5%)
   (b) Write a procedure to count the in-degree and out-degree for each node in G. (10%)