

110學年度 學士後醫學系招生考試

計算機概論與程式設計試題封面

考試開始鈴響前，請勿翻閱本試題！

★考試開始鈴響前，請注意：

- 一、除准考證、應考文具及一般手錶外；行動電話、穿戴式裝置及其他物品均須放在臨時置物區。
- 二、請務必確認行動電話已取出電池或關機，行動電話及手錶的鬧鈴功能必須關閉。
- 三、就座後，不可擅自離開座位或與其他考生交談。
- 四、坐定後，雙手離開桌面，確認座位號碼、答案卡號碼與准考證號碼相同，以及抽屜中、桌椅下或座位旁均無非考試必需用品。如有任何問題，請立即舉手反應。
- 五、考試開始鈴響前，不得翻閱試題本或作答。
- 六、考試全程不得吃東西、喝水及嚼食口香糖。
- 七、違反上述規定，依「筆試規則及違規處理辦法」議處。

★作答說明：

- 一、考試時間：100 分鐘。
- 二、本試題(含封面)共 11 頁，如有缺頁或毀損，應立即舉手請監試人員補發。
- 三、本試題單選題共 30 題、申論題 4 題，共計 100 分；每題單選題答錯倒扣，不作答不計分。
- 四、單選題答題依題號順序劃記在答案卡上，寫在試題本上無效；答案卡限用 2B 鉛筆劃記，若未按規定劃記，致電腦無法讀取者，考生自行負責。
- 五、申論題部分以「答案卷」作答，作答時不得使用鉛筆，違者該科答案卷不予計分；限用黑色或藍色墨水的筆書寫。
- 六、試題本必須與答案卡一併繳回，不得攜出試場。

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【單選題】每題 2 分，共計 60 分。答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

1. Hashing is used to create a hash table for integer keys. Let the hash table be a vector indexed from 0 to 6, the hash function be $f(x) = x\%7$ where x denotes an integer key and $\%$ is the modulo operator, and collision be solved with the linear open addressing strategy. Suppose the four integer keys: 19, 33, 8, and 54, are processed sequentially. Where is 33 placed in the hash table?
(A) The position indexed 2 (B) The position indexed 3
(C) The position indexed 4 (D) The position indexed 5
(E) The position indexed 6
2. Suppose a computer has a RAM of 1 GB. Let one addressable word consist of 4 bytes. How many address bits are required to access all the words in the RAM?
(A) 28 (B) 29 (C) 30 (D) 31 (E) 32
3. Let $x=00001111$ and $y=11111011$ be two 8-bit 2's complement binary numbers. What happens for $x + y$?
(A) The result is -12 in decimal representation.
(B) The result is 12 in decimal representation.
(C) The result is -10 in decimal representation.
(D) The result is 10 in decimal representation.
(E) Overflow occurs.
4. What is bootstrap?
(A) an I/O device
(B) a memory device
(C) an interrupt handler
(D) a processor
(E) a small initiation program to start up computers
5. CPU scheduler selects the next process for execution. There are several basic scheduling methods, such as first-in-first-out (FIFO), shortest job first (SJF), and round-robin (RR). Regarding to these methods, which of the following comments is **INCORRECT**?
(A) With FIFO, the waiting time of a process may depend on the arriving order of the processes.
(B) Starvation won't occur with FIFO.
(C) Theoretically, SJF is an optimal scheduling algorithm in terms of average waiting time.
(D) Starvation won't occur with SJF.
(E) RR is a preemptive scheduling algorithm.

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6. Virtual Memory is a storage allocation scheme in which secondary memory can be addressed as though it were part of main memory. Virtual memory can be implemented using Demand Paging. Several steps are performed in the demand paging scheme:

Step 1: Operating system (OS) puts the process in the blocking state.

Step 2: CPU is notified and the interrupted process is put in the ready state.

Step 3: The required page is brought into the memory with the page replacement algorithm.

Step 4: CPU generates an interrupt, indicating a page fault.

Step 5: Page table is updated accordingly.

Which of the following is the **CORRECT** sequence of steps performed by demand paging?

- (A) 1, 2, 3, 4, 5 (B) 2, 4, 3, 1, 5 (C) 3, 2, 5, 1, 4
(D) 4, 1, 3, 5, 2 (E) 5, 3, 1, 2, 4
7. Assume there are four frames in main memory. Consider the following page reference string: 2, 1, 6, 4, 1, 2, 5, 3, 1, 2, 1, 6, 7, 3, 6, 1, 2, 1, 6, 3. How many page faults occur for the OPT (Optimal Page-replacement Algorithm) replacement? Notes: All frames are initially empty, so the first unique pages will all cost one fault.
- (A) 7 (B) 8 (C) 9 (D) 10 (E) 11

8. Consider the execution of the following set of processes on a single-core processor.

Process	Creation Time	Required Execution Time
P ₁	0	30
P ₂	10	10
P ₃	20	20
P ₄	20	10
P ₅	80	10

Assume we use preemptive SJF (Shortest-Job-First) scheduling. What is the average waiting time?

- (A) 10 (B) 12 (C) 14 (D) 16 (E) 18
9. Suppose computers A and B have IP addresses 10.105.1.113 and 10.105.1.91, respectively, and they both use the same netmask N. Which of the values of N given below should be used if A and B belong to the same network?
- (A) 255.255.255.255 (B) 255.255.255.250
(C) 255.255.255.240 (D) 255.255.255.224
(E) 255.255.255.192

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10. Assume a network device sends out data at the rate of 4,000 bps. How long does it cost to send a file of 100,000 characters?
- (A) 100 seconds (B) 200 seconds
(C) 300 seconds (D) 400 seconds
(E) 50 seconds
11. The following code snippets have security flaws. Which of the choices below can be used as **id** to achieve the SQL Injection attack?

```
String query = "SELECT * FROM accounts WHERE custID='" +  
request.getParameter("id") + "'";
```

- (A) '1'=1' (B) custID = 1 or 1
(C) ' or '1'=1' (D) id = 0 or 1
(E) ' or '1'=0'
12. Suppose we have two tables, named TABLE-A and TABLE-B, respectively, as shown below.

A-ID	Name
1	yellow
2	green
3	pink

TABLE-A

ID	Size	Color-ID
1	seven	2
2	eight	2
3	nine	1
4	seven	3

TABLE-B

Consider the following SQL query:

```
SELECT * FROM TABLE-B  
JOIN TABLE-A ON TABLE-A.A-ID = TABLE-B.Color-ID
```

Regarding to the result of executing this query, which of the following comments is **CORRECT**?

- (A) The result is a table of 7 records.
(B) There are 5 columns in the resulting table.
(C) Green appears in three records of the resulting table.
(D) Eight appears in two records of the resulting table.
(E) JOIN cannot be performed for these two tables.

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13. In a 3-level memory hierarchy system, the hit time for each level is
T1 = 5 ns (L1-cache)
T2 = 200 ns (L2-cache)
T3 = 600 ns (Main memory)
The local hit rate in each level is H1 = 0.9 (L1-cache), H2 = 0.8 (L2-cache), and H3 = 1 (It is assumed that we can always find the data in main memory). If the average access time (ns) of this memory is K. What is the value of “**{Round(K*123)} mod 5**” ?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
14. Let AB*CD-/E+ be an postfix expression. If A=6, B=3, C=4, D=5, and E=8. What is the result of this postfix expression after evaluation?
(A) -10 (B) -8 (C) 8 (D) 9 (E) 10
15. Let the height of a tree be the number of nodes along the longest path from the root node to the leaf nodes. Consider the integers 30, 41, 25, 29, 94, 37, 70, 23, 65, 75 in the specified order to develop a binary search tree. Which of the following is **TRUE**?
(A) The node for 37 is an internal node.
(B) The root node is 41.
(C) The node for 70 has only one child.
(D) The height of the tree is 5.
(E) The node for 75 is a child of the node for 94.
16. What will be the output of the following C code ?

```
#include <stdio.h>
int main()
{
    int A[5] = {1, 2, 3, 4, 5};
    int * p = A + 3;
    printf("%d\n", p[1]);
}
```

- (A) 2 (B) 3
(C) 4 (D) 5
(E) None of the above

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17. Consider the following instruction mix for a processor:

ALU operations: 40%, uses 4 cycles.

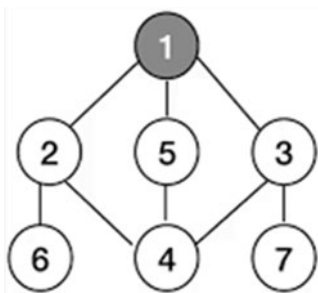
Branch operations: 30%, uses 4 cycles.

Memory references: 30%, uses 5 cycles.

The un-pipelined processor has a clock cycle time of 1 ns. The pipelined processor has a clock cycle time of 1.2 ns. Suppose that we ignore any latency and hazards, and assume that the pipelined processor has an ideal CPI (cycles per instruction) of 1. How much speedup can be achieved when comparing the un-pipelined processor and the pipelined processor?

- (A) 3.28 (B) 3.35 (C) 3.58 (D) 3.86 (E) 3.98

18. Perform a DFS (Depth-First Search) traversal of this graph by starting at node 1 and going in the order of numbers in Arabic when picking which neighbor to visit first. Which of the following is the **CORRECT** traversal order?



- (A) 1, 2, 6, 4, 5, 3, 7 (B) 1, 2, 4, 6, 5, 3, 7
(C) 1, 2, 4, 5, 6, 3, 7 (D) 1, 2, 4, 3, 7, 5, 6
(E) 1, 2, 4, 5, 3, 7, 6

19. Consider the following C code:

```
int x = 4;
for (int a = 1; a < 5; a++)
    for (int b = 1; b < 10; b += 3)
        x += 2;
```

When the code is executed, what is the final value of x?

- (A) 20 (B) 24 (C) 28 (D) 32 (E) 36

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20. What will be the output of the following C code?

```
#include <stdio.h>
int x=6;
void a()
{
    printf("%d ", x);
}
void b()
{
    x = 9;
    a();
}
int main()
{
    int x = 3;
    b();
    printf("%d ", x);
}
```

- (A) 36 (B) 39 (C) 93 (D) 63 (E) 96

21. In machine learning, one of the most common problems that will occur when we are training a model is **overfitting**. There are some techniques that could ease or even solve this problem. Which of the following technique does **NOT** alleviate overfitting problem?

- (A) Adding dropout between layers.
- (B) Increasing training epochs.
- (C) Data augmentation.
- (D) Early stopping while training model.
- (E) Using L1/L2 regularization.

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22. Consider the following C program code and statements (1)~(5).

```
#include <stdio.h>
#include <math.h>
int main(void) {
    struct listnode{
        int num;
        struct listnode *ptr;
    };
    int i,index;
    struct listnode node[10];
    for(i=0;i<20;i++){
        index = i%10;
        node[index].num = pow(i,2);
        if((index) != 9)
            node[index].ptr = &node[index+1];
        else
            node[index].ptr = &node[0];
    }
    return 0;
}
```

- (1) node[1].num = 0
- (2) node[1].num = 1
- (3) node[2].ptr->num = 9
- (4) node[9].ptr->ptr->num = 121
- (5) node[9].ptr->num = 100

Which of the following statements is **CORRECT**?

- (A) (1)(3)(4)(5)
- (B) (1)(3)
- (C) (2)(3)
- (D) (2)(3)(4)(5)
- (E) (4)(5)

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23. The following is a C program code:

```
#include <stdio.h>
#include <stdlib.h>
#define func1(X,Y) ((X) <= (Y) ? (X) : (Y))
#define func2(n) n*n
int main(void){
    int num=a, x=b, y=c;
    printf("A=%d ",func2(num+1));
    printf("B=%d ",func1(x,y));
}
```

Which one of the following statements is **CORRECT**?

- (A) When a=8, b=5, c=6, then A is 81, B is 5.
- (B) When a=8, b=5, c=6, then A is 81, B is 6.
- (C) When a=8, b=5, c=6, then A is 17, B is 5.
- (D) When a=8, b=5, c=6, then A is 17, B is 6.
- (E) When a=8, b=5, c=6, then A is 16, B is 6.

24. Suppose there are 16 users in the system, and they use symmetric encryption to achieve confidential communication, how many keys need to be managed?

- (A) 125 (B) 256 (C) 120 (D) 128 (E) 160

25. Let a, b, c be three 8-bit operands to a carry-save adder and their values be a = 00010110, b = 01101101 and c = 01001110. What are carry outputs of this carry-save adder?

- (A) 01001110 (B) 00110101
(C) 01010110 (D) 00111010
(E) 01101101

26. Which of the following activation functions can avoid the vanishing gradient problem?

- (A) ReLU (B) tanh
(C) Sigmoid (D) ELU
(E) None of the above

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27. What is the status of a process if the process stops because its time slot is over?
- (A) Waiting
 - (B) Running
 - (C) Ready
 - (D) Sleeping
 - (E) Terminated
28. In machine learning, a confusion matrix is a table that is often used to describe the performance of a classification model on a set of test data for which the true values are known. One can use the matrix to calculate the evaluation metrics, such as accuracy, precision, recall, and F1 score. Suppose a confusion matrix contains TP (true positive) = 900, FN (false negative) = 100, FP (false positive) = 50, and TN (true negative) = 950. What is the value of precision for the model?
- (A) 1850/2000
 - (B) 900/1000
 - (C) 900/2000
 - (D) 50/950
 - (E) 900/950
29. Suppose there is a two-input neuron with weights $w_1 = 3$, $w_2 = 2$, and bias $b = 1.2$. Let the activation function f be the ReLU (Rectified Linear Unit) function, defined as $f(x) = \max(0, x)$. Given the inputs $p_1 = -5$ and $p_2 = 6$. What is the output of this neuron?
- (A) 0
 - (B) 1.2
 - (C) 2.4
 - (D) -1.5
 - (E) -1.8
30. For a Generative Adversarial Network (GAN) that can produce images of cars, which of the following statements is **TRUE**?
- (1) The generator aims to learn the distribution of car images.
 - (2) After training the GAN, the discriminator loss eventually reaches a constant value.
 - (3) The generator can produce unseen images of cars.
 - (4) The discriminator can be used to classify images as car vs. non-car.
- (A) (1) and (2)
 - (B) (2) and (3)
 - (C) (1), (2) and (3)
 - (D) (2), (3) and (4)
 - (E) (1), (2), (3) and (4)

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【申論題】每題 10 分，共計 40 分。未作答或作答錯誤，不給分亦不扣分。

1. A binary tree has ten nodes. The inorder and preorder traversals of the binary tree are shown as follows.

Inorder: FKCGJBDEAI

Preorder: GFCKDJBIEA

Draw the tree.

2. In machine learning, information gain is applied for attribute selection in building a decision tree. Suppose a data set has 10 instances, each of which belongs to one of two classes, including class C1 and class C2. Among the 10 instances, 6 belong to class C1 and 4 belong to class C2. Let A be an attribute with two attribute values a1 and a2. The number of instances having A = a1 and belonging to class C1 is 2, the number of instances having A = a2 and belonging to class C1 is 4, the number of instances having A = a1 and belonging to class C2 is 4, and the number of instances having A = a2 and belonging to class C2 is 0.

- a. Determine the entropy of the data set. (4 points)
- b. Determine the average entropy of the resulting subsets obtained by splitting on attribute A. (4 points)
- c. How much information gain is obtained if attribute A is selected for the root node of the decision tree? (2 points)

Note: Please use the values: $\log_2 3 = 1.6$ and $\log_2 5 = 2.3$.

Hint: Entropy = $-\sum_{i=1}^n P_i * \log_2(P_i)$, where P_i is distribution for event i .

3. To transmit text across a network, an English character is usually encoded in 8 bits in which bits 0~6 are the ASCII code and bit 7 is used for parity checking. Suppose a string of 5 characters, **infni**, is to be transmitted and odd-parity checking is adopted. Let the ASCII code of i be 1101001, the ASCII code of n be 1101110, and the ASCII code of f be 1100110. What is the sequence of 40 bits encoded for the 5-character string? Please show the sequence in hexadecimal (base 16) form.

4. Suppose we have an array A containing 9 integers: 240, 119, 682, 341, 225, 556, 122, 661, 245, i.e. A = [240, 119, 682, 341, 225, 556, 122, 661, 245] with the first index being 0. Please convert the array A into a maxheap and show the content of A after conversion. Note that the conversion should be done in-place.