

113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 12 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. Which of the following statements about virtualization is **CORRECT**?
 - (A) Virtualization is only applicable on software layer.
 - (B) Virtualization takes less computing resources to run programs.
 - (C) Virtualization technologies can virtualize RAM and CPU, but not network.
 - (D) Virtualization can protect machines from system crashes.
 - (E) A physical machine can become multiple machines of different operating systems.

2. What is the concept of pipelining in the context of computer architecture and its impact on instruction execution in modern processors?
 - (A) Pipelining refers to the movement of data between memory and the processor.
 - (B) Pipelining involves the parallel execution of instructions within a single stage.
 - (C) Pipelining is the process of creating a pipeline for network communication in processors.
 - (D) Pipelining is a technique where multiple instructions are overlapped in execution stages, improving throughput.
 - (E) Pipelining helps in more complex data executions.

3. In computer science, numbers can be represented as either signed or unsigned. Which of the following statements accurately describes a difference between signed and unsigned numbers?
 - (A) Unsigned numbers can represent both positive and negative values, whereas signed numbers can only represent positive values.
 - (B) Signed numbers use a special “sign bit” at the least significant position to indicate whether the number is positive or negative, while unsigned numbers use this bit to extend their range of positive values.
 - (C) The range of values that can be represented by signed and unsigned numbers of the same bit length is the same, but signed numbers use a different encoding to represent negative values.
 - (D) Unsigned numbers are always larger than signed numbers because they use an extra bit to represent the magnitude of the value.
 - (E) Signed numbers use one bit to indicate the sign (positive or negative) of the number, allowing them to represent both positive and negative values. Unsigned numbers do not have a sign bit and can only represent positive values or zero.

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4. In the context of pipelined CPU architecture, which of the followings best describes how hazards, exceptions, and parallelism interact to affect the performance and correctness of program execution?
- (A) Data hazards occur when parallel execution of instructions creates a dependency on the outcome of an exception, leading to incorrect program execution unless properly managed.
 - (B) Control hazards are resolved using speculative execution, which relies on predicting exceptions and rerouting data paths in the pipeline to maintain parallelism without stalling.
 - (C) Parallelism enhances the handling of exceptions by allowing the CPU to process multiple exception routines simultaneously, reducing the overall impact on execution time.
 - (D) Exceptions, such as interrupts or faults, are handled by temporarily suspending parallel execution, resolving the exception, and then resuming execution, potentially introducing control hazards.
 - (E) Structural hazards are mitigated by designing a CPU with multiple execution units, allowing for parallel execution of instructions and reducing the likelihood of pipeline stalls due to resource conflicts.
5. When a process is being switched out of the CPU, which of the following situations does **NOT** cause the process that is being added to the wait/ready queue?
- (A) I/O request
 - (B) Sleep execution
 - (C) Time slice expired
 - (D) Wait for an interrupt
 - (E) Create child process
6. In a concurrent computing environment, semaphores are used to control access to shared resources and prevent race conditions. Which of the following statements accurately describes the primary mechanism by which semaphores achieve this?
- (A) Semaphores expedite process execution by enabling all waiting processes to access the critical section simultaneously if the semaphore count is positive.
 - (B) Semaphores use a counter to manage how many processes can simultaneously access a critical section of code, effectively ensuring mutual exclusion and synchronization.
 - (C) Semaphores eliminate the need for process synchronization by allowing unrestricted access to shared resources, relying on the operating system to manage concurrency.
 - (D) Semaphores utilize hardware interrupts to pause the execution of processes trying to enter a critical section until it becomes available, ensuring orderly access.
 - (E) Semaphores automatically resolve deadlocks by preempting resources from processes, thus allowing other processes to proceed without waiting.

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7. For the process shown in the table below: [time unit: ms]

Process ID	Arriving Time	Burst Time	Priority
A	0	6	3
B	3	2	2
C	7	5	1
D	8	9	4

Please find the average waiting time if the processes are conducted in Preemptive-Priority.

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

8. Suppose we have a processor with a base CPI of 1.0, assuming all references hit in the main memory, and the main memory access time of 100 clock cycles, include all the miss handling. Suppose 60% of instructions would access memory, and the miss rate of instruction cache is 0.2%, the miss rate of data instruction cache is 1%. The effective CPI = n. What is the value of $\text{round}(n) \bmod 5$?

- (A) 0 (B) 1 (C) 2
(D) 3 (E) 4

9. Your company has a class C network 192.168.113.0. Which of the following address pairs is located in the same subnet if you want to divide the network into six useable subnets?

- (A) (192.168.113.1, 192.168.113.254)
(B) (192.168.113.94, 192.168.113.97)
(C) (192.168.113.38, 192.168.114.46)
(D) (192.168.113.36, 192.168.113.48)
(E) (192.168.113.157, 192.168.113.165)

10. Which of the following statements is **CORRECT** for the TCP/IP network protocols?

- (A) TCP is called a connectionless communication while UDP is called a connection-oriented communication.
(B) Router is an OSI Layer 2 device which can only forward data based on the MAC address.
(C) ARP (Address Resolution Protocol) can be used to change several private addresses under the LAN (Local Area Network) to a single public IP address.
(D) For establishing a reliable connection, UDP uses a three-way handshake to enhance the robustness.
(E) The flags in the TCP packet are used to indicate a particular state during the TCP conversation.

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11. Given a database table named “animal” with four columns, please find out a **CORRECT** SQL command that can obtain the desired output as below.

animalid	name	born	category
1	Jimmy	2023-04-18	dog
2	Mary	2023-03-12	cat
3	John	2023-03-29	dog
4	Candy	2023-04-04	cat
5	Abel	2023-02-13	bird
6	Maria	2023-03-25	fish
7	Tracy	2022-12-24	fish
8	Herbert	2023-02-11	dog
9	Tina	2023-02-21	bird
10	Susanna	2023-04-12	dog
11	Guy	2023-02-28	bird

The output of the SQL command

category	countaid
dog	3
bird	2
cat	2

- (A) SELECT category, count(animalid) as countaid FROM animal WHERE born > '2023-02-14' AND count(animalid)>=2 GROUP BY category ORDER BY count(animalid) DESC, category ASC
- (B) SELECT category, count(animalid) as countaid FROM animal WHERE born > '2023-02-14' GROUP BY category HAVING count(animalid)>=2 ORDER BY count(animalid) DESC, category ASC
- (C) SELECT category, count(animalid) as countaid FROM animal GROUP BY category HAVING count(animalid)>=2 AND born > '2023-02-14' ORDER BY count(animalid), category DESC
- (D) SELECT category, count(animalid) as countaid FROM animal WHERE count(animalid)>=2 GROUP BY category HAVING born > '2023-02-14' ORDER BY count(animalid) DESC, category ASC
- (E) SELECT category, count(animalid) as countaid FROM animal WHERE born > '2023-02-14' GROUP BY category ORDER BY count(animalid) DESC, category ASC

12. Given a binary tree whose prefix order is ABCDEF and infix CBDAEF, what is its postfix order?

- (A) BCDFEA
- (B) CBDFEA
- (C) CDBFEA
- (D) CDBEFA
- (E) Undecided

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13. What is an IP address? What are the differences between IPv4 and IPv6 addresses?

- (A) An IP address is a numerical identifier that identifies the location of a host or network device on a network. IPv4 addresses are 32-bit addresses, while IPv6 addresses are 128-bit addresses.
- (B) An IP address is an alphanumeric code used to identify the location of a device on the Internet. IPv4 addresses are 32-bit addresses, while IPv6 addresses are 64-bit addresses.
- (C) An IP address is a numerical identifier that identifies the location of a host or network device on the Internet. IPv4 addresses are 128-bit addresses, while IPv6 addresses are 32-bit addresses.
- (D) An IP address is an alphanumeric code used to identify the location of a device on a network. IPv4 addresses are 128-bit addresses, while IPv6 addresses are 32-bit addresses.
- (E) An IP address is a numerical identifier that identifies the location of a host or network device on a network. There are no significant differences between IPv4 and IPv6 addresses.

14. According to the three database tables listed below, which of the following statements is **CORRECT** if you want to create a relational database model?

Supplier

SID	Name	Address	City	Phone
123	John	412 Zhongshan	Tainan	06333
124	Mary	062 Bade	Taipei	02999
279	Jimmy	17 Renai	Kaohsiung	07123
364	Ted	55 Zhenjiang	Hsinchu	03567

Purchase

PID	Date	SID	EID
1234	2023/1/9	123	319
1238	2023/1/9	123	214
2219	2023/8/3	364	319
2654	2023/9/4	279	823

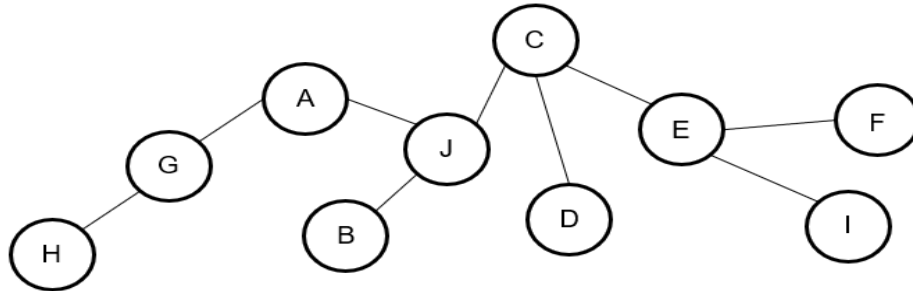
Employee

EID	Name	Salary	Phone
214	Bryan	32,400	02999
319	Angel	29,300	05173
823	Karl	31,700	07888

- (A) There is no possible foreign key that can be used in "Purchase" table.
- (B) EID can be regarded as a primary key in "Purchase" table.
- (C) There is a one-to-many relationship between "Employee" and "Purchase" tables.
- (D) Every table must have a foreign key to uniquely identify a particular row.
- (E) If we want to query Employee's names in the Purchase with PID= "1234" and "1238", it is a better approach to use UNION in SQL command.

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15. Which of the followings is the path for BFS algorithm? (The starting point is the first element of each of the following path)



- (A) H→G→A→J→B→C→D→E→F→I
- (B) B→J→C→E→F→I→D→A→G→H
- (C) J→A→G→H→B→C→D→E→I→F
- (D) H→B→D→I→F→G→E→A→C→J
- (E) H→G→A→J→C→E→I→F→D→B

16. Which one of the following statements is the biggest, when n approaches to ∞ ?

- (A) $n \log n$
- (B) 2^n
- (C) $n!$
- (D) n^{200}
- (E) n^{1000}

17. Which is the answer of printf?

```
#include <stdio.h>
int min(int a, int b) {return a < b ? a : b;}
int test(int n) {
    if (n == 1) {return 0;}
    else if (n == 2) {return 1;}
    else if (n % 2 == 0) {return test(n / 2) + 1; }
    else {return min(test((n + 1) / 2), test((n - 1) / 2)) + 2;}}
int integerReplacement(int n) {
    if (n == 1) {return 0;}
    return test(n);}
int main() {
    int number=15;
    printf("%d\n", integerReplacement(number));
    system("pause");
    return 0;}
```

- (A) 4
- (B) 5
- (C) 6
- (D) 7
- (E) 8

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18. In programming, what is the primary purpose of pointers?

- (A) To speed up program execution
- (B) To manage memory addresses, enabling indirect access to variables and arrays
- (C) To reduce compilation time
- (D) To enhance the program's security
- (E) To automatically generate code

19. $f(x)$ is a function of Fibonacci-like, that is $f(0) = 2$ and $f(1) = 3$; otherwise, $f(x) = f(x-1) + f(x-2)$. Which one of the following answers is $f(9)$?

- (A) 5
- (B) 12
- (C) 89
- (D) 144
- (E) 233

20. You are given a Python function that is supposed to implement the binary search algorithm to find the index of a target element in a sorted list. However, there is a mistake in the code. Identify the mistake and provide the corrected version of the code.

```
def binary_search(arr, target):  
    left, right = 0, len(arr)  
    while left <= right:  
        mid = (left + right) // 2  
        if arr[mid] == target:  
            return mid  
        elif arr[mid] < target:  
            left = mid + 1  
        else:  
            right = mid - 1  
    return -1
```

- (A) Change `len(arr)` to `len(arr)-1`
- (B) Change the condition in the while loop to `while left < right`
- (C) Change `left=mid+1` to `left=mid`
- (D) Change `right=mid-1` to `right=mid`
- (E) Add a condition to handle the case when the target is not found in the list

21. The Advanced Encryption Standard (AES) uses arithmetic in Galois field $GF(2^8)$, with the irreducible polynomial $m(x)=x^8+x^4+x^3+x+1$. Find out the result of the multiplication of two byte states $\{53\}_{\text{hex}}$ and $\{A4\}_{\text{hex}}$ in $GF(2^8)$.

- (A) $\{D9\}_{\text{hex}}$
- (B) $\{D7\}_{\text{hex}}$
- (C) $\{F7\}_{\text{hex}}$
- (D) $\{4F\}_{\text{hex}}$
- (E) $\{6C\}_{\text{hex}}$

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22. Which is a **CORRECT** output for the following C program?

```
#include <stdio.h>
void cubecomp1(int *nPtr);
int cubecomp2(int n);
int main(){
    int number = 2;
    cubecomp1(&number);
    cubecomp2(number);
    printf("%d ", number);
    return 0;
}
void cubecomp1(int *nP){
    *nP = *nP * *nP * *nP;
}
int cubecomp2(int n){
    n = n * n * n;
    printf("%d ", n);
}
```

- (A) 8 8 (B) 64 8 (C) 512 512
(D) 512 8 (E) 64 64

23. Which of the followings best describes the concept of differential privacy in the context of data privacy protection?

- (A) Encrypting sensitive data using strong cryptographic algorithms
- (B) Anonymizing personally identifiable information to protect individuals' identities
- (C) Adding noise to sensitive data to prevent the disclosure of individual records
- (D) Restricting access to data based on user roles and permissions
- (E) Implementing secure authentication mechanisms to control data access

24. In information security, which technology ensures that only the recipient with the shared secret key can decrypt the ciphertext and read the transmitted information?

- (A) Symmetric Encryption
- (B) Asymmetric Encryption
- (C) Hash Functions
- (D) Multi-Factor Authentication
- (E) Digital Signature

25. Which of the followings best describes a buffer overflow vulnerability?

- (A) Allowing unauthorized access to restricted files or directories
- (B) Executing arbitrary code by injecting malicious SQL queries
- (C) Overloading a server by sending a large volume of requests in a short time
- (D) Writing data beyond the bounds of a fixed-size buffer, leading to memory corruption
- (E) Intercepting and decrypting network traffic to steal sensitive information

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26. Which of the following situations describes the machine learning model that matches too closely to the training data, performing excellently on the training data but poorly on new samples?
- (A) Max Pooling
 - (B) Random Forest
 - (C) Generative Adversarial Network
 - (D) Mean Square Error
 - (E) Overfitting
27. In machine learning, what is regularization?
- (A) Regularization is a technique to increase model complexity in order to improve its performance on training data.
 - (B) Regularization is a technique to decrease model complexity in order to reduce its performance on training data.
 - (C) Regularization is a technique to reduce model overfitting by adding extra terms to the objective function to limit the size of model parameters.
 - (D) Regularization is a technique to increase model overfitting in order to improve its performance on training data.
 - (E) Regularization is a technique to reduce model overfitting by increasing the amount of training data to enhance the model's generalization ability.
28. What is LoRaWAN?
- (A) LoRaWAN is a wireless radio frequency communication technology, characterized by providing low-power long-distance communication suitable for IoT devices.
 - (B) LoRaWAN is a cellular network technology, with no significant difference from traditional cellular networks.
 - (C) LoRaWAN is a solar-powered IoT technology, characterized by providing efficient low-power communication.
 - (D) LoRaWAN is a wireless local area network technology, offering longer communication distances compared to traditional Wi-Fi.
 - (E) LoRaWAN is a wireless bridging technology for IoT, primarily used to connect different IoT devices.
29. In the context of generative AI, which technique involves training a model to predict the next token in a sequence based on the previous tokens?
- (A) Reinforcement learning
 - (B) Markov chain Monte Carlo sampling
 - (C) Variational autoencoder
 - (D) Long short-term memory networks
 - (E) Generative adversarial networks

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30. In the Internet of Things (IoT), what is the MQTT protocol?
- (A) MQTT is a protocol for communication between IoT devices, with its main feature being the ability to provide real-time communication.
 - (B) MQTT is a protocol for communication between IoT devices, with its main feature being to provide efficient low-power communication.
 - (C) MQTT is a protocol for communication between IoT devices, with its main feature being to provide highly secure communication.
 - (D) MQTT is a protocol for communication between IoT devices, with its main feature being the ability to provide wide-area network communication.
 - (E) MQTT is a protocol for communication between IoT devices, with its main feature being to provide highly scalable communication.

【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. What will be the output of the following code?

```
#include <stdio.h>
int main() {
    int arrayA[3][3]={{1,3,5},{2,4,6},{8,10,12}};
    int arrayB[3][3]={{2,4,6},{7,8,9},{10,11,12}};
    int number;
    for(int i=0;i<3;i++){
        for(int j=0;j<3;j++){
            number=arrayA[i][j]*arrayB[i][j];
            printf("%4d ",number);
        }
        printf("\n");
    }
    system("pause");
    return 0;
}
```

2. Assume that there is a four-frame physical memory in the system. Initially, all frames are empty. Given the reference string: ACDFCBCADAFBAC, how many page faults generated by the LRU page replacement scheme? Show your work.
3. Hamming code is a technique used to detect and correct errors in data transmission. It achieves this by adding specific check bits to the data bits. It enhances the reliability and stability of systems. After encoding with Hamming code, the value is 1101110101. Which bit is **INCORRECT**, and what is the **CORRECT** value?

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4. The results of a hypothetical study to measure test performance of the PCR (polymerase chain reaction) test for Covid-19 are shown in the following table.

PCR test result	Gold standard test positive	Gold standard test negative	Total
Positive PCR	106	25	131
Negative PCR	5	64	69
Total	111	89	200

Calculate the (A) accuracy, (B) precision (positive predictive rate, PPV), (C) recall (sensitivity, true positive rate, TPR), (D) true negative rate (TNR) and (E) F1-measure.

Note: Show the result by rounding up the 3rd digit after the decimal point, e.g. 0.9876 should be 0.988.