國立成功大學

115學年度碩士班招生考試試題

編　號：163

系　所：資訊管理研究所

科　目：計算機概論

日　期：0203

節　次：第 2 節

注　意：1.不可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

Part A:

A-1. Multiple Choice (choose only ONE answer for each question) (40%):

1.1. Which of the following best describes the primary role of a process control block (PCB)?

A. It stores the executable code of a program

B. It keeps track of memory addresses for virtual memory paging

C. It maintains information needed to manage and schedule a process

D. It handles communication between hardware devices

1.2. Which protocol is primarily responsible for resolving a domain name into an IP address?

A. ARP

B. DNS

C. DHCP

D. ICMP

1.3. Which of the following attributes is most suitable as a primary key?

A. Customer name

B. Email address

C. Student ID number

D. Home address

1.4. Which concept allows a subclass to provide a specific implementation of a method already defined in its superclass?

A. Encapsulation

B. Overloading

C. Overriding

D. Aggregation

1.5. Which security principle ensures that data cannot be altered without authorization?

A. Confidentiality

B. Availability

C. Authentication

D. Integrity

1.6. Which characteristic of cloud computing allows users to pay only for the resources they actually use?

A. Virtualization

B. Scalability

C. Elasticity

D. Measured service

1.7. Which data structure is most appropriate for implementing a first-in, first-out (FIFO) service system?

A. Stack

B. Queue

C. Tree

D. Graph

1.8. Which diagram in UML is most suitable for describing interactions between objects over time?

A. Class diagram

B. Use case diagram

C. Sequence diagram

D. State diagram

A-2. (5%) In one sentence, what is the main purpose of normalization in relational database design?

A-3. (5%) In one sentence, explain the Von Neumann bottleneck.

Part B.

I. Single Choice (28%) ***(Choose the best answer)***

B.1 Please derive the 8-bit **two's complement representation** of -57.

(A). 00111001
(B). 11000111
(C). 11100111
(D). 10011101
(E). 11100110

B.2 In modern computer architecture, **CPUs** and **GPUs** exhibit different characteristics in their computational nature. Which of the following statements about them is most accurate?

(A). CPUs and GPUs share the same ISA, so their cache hierarchy can directly share data.
(B). CPUs emphasize a small number of complex cores, suitable for control and sequential execution; GPUs consist of many simple cores, suitable for parallel computation and large-scale data processing.
(C). GPU cache design focuses on latency hiding and throughput improvement, so when cooperating with CPUs, it can significantly reduce memory bottlenecks.
(D). In system architecture, GPUs act as accelerators, while CPUs handle task dispatch and control flow management; their interaction relies on hardware drivers for data exchange and synchronization.
(E). GPUs are the "brains" of a computer, designed for versatile tasks, while CPUs are the "muscles," optimized for massive parallel processing, especially graphics and data-heavy workloads.

B.3 In a management information system, an AI model is used for fraud detection. Suppose the model has an accuracy of 95%, and the dataset contains 10,000 transactions, of which 1% are fraudulent. How many fraudulent transactions is the model expected to **detect correctly**?

(A). 9,500
(B). 100
(C). 95
(D). 9,000
(E). 950

B.4 An information management system supports three search methods on datasets of size n: **Linear Search**, **Binary Search**, and **Hash Lookup**. Compare their average-case and worst-case time complexities. Which statement is most accurate?

(A). Average-case: Binary $O(\log n)$ < Hash $O(1)$ < Linear $O(n)$
(B). Worst-case: Hash $O(n)$ < Binary $O(\log n)$ < Linear $O(n)$
(C). Average-case: Linear $O(n)$ < Binary $O(\log n)$ < Hash $O(1)$
(D). Worst-case: Binary $O(\log n)$ < Linear $O(n)$ = Hash $O(n)$
(E). Average-case: Hash $O(1)$ < Linear $O(n)$ < Binary $O(\log n)$

B.5 The success of modern **Large Language Models** (LLMs) is primarily attributed to the Transformer architecture. Which of the following is its key advantage?

(A). Reliance on Recurrent Neural Networks (RNNs).

(B). Ability to capture long-range dependencies and support parallel processing of sequences.

(C). Use of Convolutional Neural Networks (CNNs) to extract local features.

(D). Effective handling of structured data in unsupervised learning.

(E). Perfectly predicting the future by analyzing text data.

B.6 In terms of memory management and operational efficiency, why do **arrays** usually have better cache performance, while **linked lists** are more advantageous for frequent insertions and deletions?

(A). Array data is stored in registers; linked lists are allocated on the stack.

(B). Arrays use pointers to connect elements; linked lists allocate memory continuously.

(C). Array elements are stored contiguously, improving cache locality; linked lists can perform insertions/deletions in $O(1)$ time when the node position is known.

(D). Arrays automatically expand without moving data; linked lists store both data and pointers.

(E). Arrays are faster for insertions, while linked lists are faster in cache

B.7 The following C code attempts to implement an **optimized Bubble Sort**. What should be filled in at the missing part?

```
1  void bubbleSort(int arr[], int n) {
2      int i, j, temp;
3      int swapped;
4      for (i=0; i<n-1; i++) {
5          swapped=0;
6          for (j=0; j<n-i-1; j++)   {
7              if (arr[j]>arr[j+1]) {
8                  temp = arr[j];
9                  arr[j]=arr[j+1];
10                 arr[j+1]=temp;
11                 swapped=1;
12             }
13         }
14     }
15         // Missing Part
16 }
```

(A). if (swapped == 0) break;

(B). if (swapped == 1) continue;

(C). if (arr[j] == arr[j+1]) break;

(D). if (i == n-1) return;

(E). if (i == j-1) continue;

II. Free Response *(Answer concisely)*

B.8 **Fine-tuning** and **Retrieval-Augmented Generation** (RAG) are two common techniques applied to Large Language Models (LLMs) in recent years. Please answer the following questions about the two techniques.

i. How does the model acquire and update new knowledge? (4%)

ii. What types of tasks are suitable? (4%)

iii. Compare their performance in terms of accuracy, scalability, and maintenance cost. (4%)

B.9 Please read the following **program fragment** carefully and answer the subsequent questions.

```
1  #include<stdio.h>
2  int counter = 10;
3  void increment() {
4      int counter = 5;
5      counter++;
6      printf("Local counter = %d\n", counter);
7  }
8
9  int main() {
10     int counter=2;
11     printf("Main counter = %d\n", counter);
12     increment();
13     printf("Global counter = %d\n", counter);
14 }
```

i. Identify all the variables declared in this program and specify whether they are **global** or **local**. (3%)

ii. What will be the **output results** of each variable? (3%)

iii. If we **remove the local variable** counter inside increment( ), how will the output change? (4%)