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一、單選題（每題 2 分，共 36 分）　　**選擇題請在答案卡上作答。**

1. What is the purpose of a timestamp-based concurrency control method?

   (A) To ensure transactions are executed in a specific order

   (B) To reduce the number of locks required

   (C) To improve query performance

   (D) To manage disk space

2. What is the purpose of a two-phase commit protocol?

   (A) To ensure all participants in a distributed transaction agree on the outcome

   (B) To improve query performance

   (C) To reduce storage costs

   (D) To simplify database design

3. What is a transitive dependency in the context of normalization?

   (A) A dependency where one non-key attribute depends on another non-key attribute

   (B) A dependency where a non-key attribute depends on the primary key

   (C) A dependency where a key attribute depends on a non-key attribute

   (D) A dependency where a table depends on another table

4. Which normal form eliminates transitive dependencies?

   (A) First Normal Form (1NF)

   (B) Second Normal Form (2NF)

   (C) Third Normal Form (3NF)

   (D) Boyce-Codd Normal Form (BCNF)

5. Which of the following is NOT a type of database security threat?

   (A) SQL Injection

   (B) Denial of Service (DoS)

   (C) Data Normalization

   (D) Phishing

6. Which of the following is a common technique to prevent SQL injection attacks?

   (A) Using strong passwords

   (B) Encrypting data

   (C) Using parameterized queries

   (D) Normalizing data

7. Which of the following best describes domain integrity?

   (A) Ensuring that each row in a table is unique

   (B) Ensuring that relationships between tables remain consistent

   (C) Ensuring that data entries are valid and within a specific range

   (D) Ensuring that data is backed up regularly

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8. What is a clustered index?

   (A) An index that stores data in a random order

   (B) An index that stores data in the same order as the table

   (C) An index that stores data in a separate table

   (D) An index that stores data in a compressed format

9. Which of the following statements is true about indexing?

   (A) Indexes always improve query performance

   (B) Indexes can slow down data modification operations

   (C) Indexes reduce the need for normalization

   (D) Indexes are only used in relational databases

10. Which of the following best describes a star schema?

    (A) A schema with a central fact table connected to multiple dimension tables

    (B) A schema with multiple fact tables connected to a single dimension table

    (C) A schema with no relationships between tables

    (D) A schema with only one table

11. Given an OS with a byte-oriented page memory system, consider a <u>16-bits logical address space</u> mapped onto a <u>physical memory of 512 frames</u>. Suppose the page size is 1024 bytes. Hence, there are α pages in the logical space and β bits are required (i.e., minimum) to present the physical address. What is the pair (α, β)?

    (A) (64, 20)

    (B) (32, 19)

    (C) (128, 20)

    (D) (128, 19)

    (E) (64, 19)

12. What is the main difference between the "Multilevel Queue" and "Multilevel Feedback Queue" scheduling algorithms?

    (A) process migration among queues

    (B) number of queues

    (C) time quantum

    (D) level definition

    (E) size of queue

13. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for C-SCAN and C-LOOK disk-scheduling algorithms, respectively?

    (A) 7081, 1745

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　　　(B) 9813, 3363

　　　(C) 9769, 3319

　　　(D) 9769, 1745

　　　(E) 7081, 3319

14. How many times does the following program print hello?

```c
#include <stdio.h>
#include <unistd.h>
main () {
    if ( fork () == 0)
        printf ("hello\n");
    else if ( fork () == 0)
        printf ("hello\n");
    printf ("hello\n");
}
```

(A)　2

(B)　3

(C)　4

(D)　5

(E)　6

15. 6 顆一模一樣的硬碟構成 RAID(redundant array of inexpensive disks)磁碟陣列，下列那一種磁碟陣列組態可儲存的有效資料量最小？

(A) RAID 0

(B) RAID 1

(C) RAID 01

(D) RAID 5

(E) RAID 6

16. 所謂殭屍網路(BotNet)攻擊，是指下列何種對電腦的入侵？

(A) 程式中加上特殊的設定，使程式在特定的時間與條件下自動執行而引發破壞性的動作

(B) 建立與合法網站極為類似的網頁，誘騙使用者在網站中輸入自己的帳號密碼

(C) 利用軟體本身在安全漏洞修復前進行攻擊

(D) 散佈具有遠端遙控功能的惡意軟體，並且集結大量受到感染的電腦進行攻擊

(E) 修改系統設定檔，以破壞檔案並且鎖住相關權限

17. 作業系統如何維護許多行程同時開啟相同的檔案？

(A) 只使用一個內部表格(internal table)來追蹤開啟的檔案

(B) 使用兩個內部表格(internal tables)稱為 system-wide table 與 per-disk table，來追蹤開啟的檔案

(C) 使用兩個內部表格(internal tables)稱為 system-wide table 與 per-process table，來追蹤開啟的檔案。

(D) 使用三個內部表格(internal tables)，稱為 system-wide table、per-disk table 與 per-partition table，來追蹤開啟的檔案

(E) 使用四個內部表格(internal tables)，稱為 system-wide table、per-disk table、per-process table，與 per-partition table，來追蹤開啟的檔案

18. 若某檔案(檔名 file123)包含以下數行內容：

    ncuim department

    NCUIM lab

    ncuimschool

    REGIONNCUIM

    university ncuim

    NCUIM CENTER

請問使用哪個 grep 指令可以搜尋檔案中以"ncuim"結尾，且顯示符合行的行號？

(A) grep -n '^ncuim' file123

(B) grep 'ncuim$' -i file123

(C) grep -i 'ncuim$' -l file123

(D) grep -n 'ncuim$' file123

(E) grep -i -n 'ncuim$' file123

二、複選題 (每題 2 分，全對才給分，共 34 分)　　**選擇題請在答案卡上作答。**

19. Which of the following keywords are used for exception handling in Java?

(A) try

(B) catch

(C) finally

(D) throw

20. Which of the following statements about the *finally* block are true?

(A) It is always executed after the try block, regardless of whether an exception is thrown.

(B) It is executed only if an exception is thrown.

(C) It is executed only if no exception is thrown.

(D) It is used to execute important code such as closing resources.

21. Which of the following can be used to create a custom exception in Java?

(A) Extending the Exception class

(B) Extending the RuntimeException class

(C) Implementing the Throwable interface

(D) Extending the Error class

22. Which of the following are true about method overloading in Java?

(A) It allows multiple methods with the same name but different parameters.

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    (B) It is a form of polymorphism.

    (C) It allows methods to have the same name and same parameters.

    (D) It is resolved at compile time.

23. Which of the following are true about method overriding in Java?

    (A) It allows a subclass to provide a specific implementation of a method already defined in its superclass.

    (B) It is a form of polymorphism.

    (C) It is resolved at runtime.

    (D) It allows methods to have the same name but different parameters.

24. Which of the following are true about the *synchronized* keyword in Java?

    (A) It can be used to synchronize methods.

    (B) It can be used to synchronize blocks of code.

    (C) It ensures that only one thread can access the synchronized code at a time.

    (D) It can be used to synchronize constructors.

25. Consider the following Java program:

```java
public class Animal {
    private String name;
    private int age;
    private String type;

    // Constructor 1
    public Animal(String name) {
        this.name = name;
    }

    // Constructor 2
    public Animal(String name, int age) {
        this(name); // Calling Constructor 1
        this.age = age;
    }

    // Constructor 3
    public Animal(String name, int age, String type) {
        this(name, age); // Calling Constructor 2
        this.type = type;
    }
```

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```java
        // Constructor 4
        public Animal(int age, String type) {
            this.age = age;
            this.type = type;
        }

        public void display() {
            System.out.println("Name: " + name + ", Age: " + age + ", Type: " + type);
        }

        public static void main(String[] args) {
            Animal a1 = new Animal("Lion");
            Animal a2 = new Animal("Tiger", 5);
            Animal a3 = new Animal("Elephant", 10, "Mammal");
            Animal a4 = new Animal(3, "Reptile");
            a1.display();
            a2.display();
            a3.display();
            a4.display();
        }
    }
```

Which of the following statements are true about the above program? (Select all that apply)

(A) The program will compile and run without errors.

(B) The constructor Animal(String name, int age) correctly calls another constructor using this(name).

(C) The constructor Animal(String name, int age, String type) correctly calls another constructor using this(name, age).

(D) The constructor Animal(int age, String type) will cause a compilation error because it does not call another constructor.

(E) The display method will print null for the name field of the Animal object created with Animal(int age, String type).

26. Consider the following Java program:

```java
class Animal {
    public void makeSound() {
        System.out.println("Some generic animal sound");
    }
}
```

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```java
class Dog extends Animal {
    @Override
    public void makeSound() {
        System.out.println("Bark");
    }

    public void fetch() {
        System.out.println("Fetching...");
    }
}

class Cat extends Animal {
    @Override
    public void makeSound() {
        System.out.println("Meow");
    }

    public void scratch() {
        System.out.println("Scratching...");
    }
}

public class Main {
    public static void main(String[] args) {
        Animal a1 = new Dog();
        Animal a2 = new Cat();
        a1.makeSound();
        a2.makeSound();

        a1.fetch();
        a2.scratch();
    }
}
```

Which of the following statements are true about the above program? (Select all that apply)

(A) The program will compile and run without errors.

(B) The makeSound method in the Dog class overrides the makeSound method in the Animal class.

(C) The makeSound method in the Cat class overrides the makeSound method in the Animal class.

(D) The fetch method in the Dog class can be called using the a1 reference.

(E) The scratch method in the Cat class can be called using the a2 reference.

27. Which of the following statements about the Java Collections Framework are true? (Select all that apply)

(A) The List interface allows duplicate elements.

(B) The Set interface allows duplicate elements.

(C) The Map interface allows duplicate keys.

(D) The Queue interface follows the First-In-First-Out (FIFO) principle.

28. Which of the following statements about the Java Virtual Machine (JVM) are true? (Select all that apply)

(A) The JVM is responsible for converting Java bytecode into machine code.

(B) The JVM provides platform independence for Java programs.

(C) The JVM performs garbage collection to manage memory.

(D) The JVM is part of the Java Development Kit (JDK).

29. Which following information is stored in process control block (PCB) of a process?

(A) scheduling information

(B) accounting information

(C) inter communication information

(D) I/O status information

(E) process state information

30. What are advantages for an OS system adopting virtual memory strategy?

(A) more efficient for thread creation

(B) logical address space can be larger than physical address space

(C) less I/O needed to load or swap processes

(D) more effective for selecting process on CPU scheduling

(E) only part of the program needs to be in memory for execution

31. A solution to the critical-section problem must satisfy which requirements?

(A) mutual exclusion

(B) circular wait

(C) progress

(D) no preemption

(E) bounded waiting

32. What transparencies are important and critical for design a distributed file system?

(A) penalty transparency

(B) access transparency

(C) scaling transparency

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　　(D) mobility transparency

　　(E) communication transparency

33. What are the correct descriptions of deadlock and livelock?

　　(A) Processes in deadlock can not proceed until the other processes releases the resource

　　(B) A livelock exists if the processes are changing their state infrequently and proceeding ineffectively.

　　(C) Processes in livelock constantly change their state in response to each other, but none of them can make any progress

　　(D) One way to prevent a deadlock is to use a resource ordering protocol for assigning a unique priority to each resource

　　(E) One way to detect a livelock is to monitor and reorder the states of the processes over time

34. 以下那些指令，會使檔案(檔名 file123)的檔案所屬群組無法寫入該檔案？

　　(A) chmod w-g file123

　　(B) chmod 740 file123

　　(C) chmod 450 file123

　　(D) chmod 460 file123

　　(E) chmod 770 file123

35. 下列敘述何者正確？

　　(A) 反斜線 (\) 可以取消後面字元的特殊意義，因此輸入

　　　　echo * star *

　　　　會在螢幕上看到　* star *

　　(B) 雙引號 (" ") 會取消引號內所有字元的特殊意義。

　　(C) 執行 echo Today is = `date`

　　　　會先執行　date 取得目前日期，再將結果插入到　echo　中一同輸出。

　　(D) 執行　echo 'Today is = `date`'

　　　　會顯示　Today is = [當前日期]，因為單引號內的反向單引號仍能被執行。

　　(E) 執行　echo "Today is = `date`"

　　　　會顯示　Today is = [當前日期]，因為雙引號內的反向單引號仍能被執行。

三、問答題 (共 30 分)　　　非選擇題請在答案卷(作答區內)作答。

36. 為了滿足 IoT(Internet of Things) 龐大的 IP 位址需求，IPv6 的使用將會日益普及，請列出並詳細說明三項 IPv4 和 IPv6 的不同之處。(15%)

37. 在使用防火牆的企業網路架構中，常配置一個被稱為 DMZ（Demilitarized Zone）的網段，請說明該網段的功用為何？另外 WAF（Web Application Firewall）和封包過濾式防火牆（Packet filtered Firewall）有何不同？請詳細說明。(15%)