所別： 資訊管理暨大數據分析類

科目： 計算機概論

＊本科考試禁用計算器 申論題及簡答題

1. （10%）請詳細說明 QUIC（Quick UDP Internet Connection）協定的發展背景與特色。

2. （20%）在今日網路環境，無論對個人或企業，VPN（Virtual Private Network）都是重要的網路安全工具。請先說明 VPN 的一般功能，然後比較 IPSec VPN, SSL VPN 以及 MPLS VPN 三者之間的區別。

3. （15%）給定一作業系統，安裝於硬體的 TLB（Translation Look-aside Buffer）大小為 1024，記憶體的搜尋時間為 200 ns(nanosecond)的電腦上。假設系統的 TLB 命中率為 90%，且 TLB 搜尋時間為 20 ns(nanosecond)。若此系統採用的分頁表大小為 64，分頁表中存放的每個基底位置為 11 bits（包含有 valid/invalid bit），每個分頁大小為 512 B，請回答下列問題。

   甲、此系統的 TLB 觸及範圍(TLB Reach)為多少？（5%）

   乙、此系統的實體位址空間大小為何？（5%）

   丙、若分頁表採取了三階層式(three-level)的實作方式，其記憶體有效存取時間(effective access time)為何？（5%）

4. （5%）考慮一程式碼區段：

```
pid_t pid;

pid = fork();
if (pid == 0) { /* child process */
      fork();
      thread_create( . . .);
}
fork();
```

   甲、請問會產生多少個獨立的行程(process)？（2%）

   乙、請問會產生多少個獨立的執行緒(thread)？（3%）

5. 資料庫正規化中的 1NF、2NF 與 3NF 是以哪一重要觀念發展出來的？ （5%）

6. 給定一段 C 語言程式碼，

```
int a = 11, b = 21;
int *p;
p = &a;
b = *p;
*p = 0;
```

   已知存放 a 變數的記憶體位置為 0X0012FF74；b 變數的記憶體位置為 0X0012FF78。請問，執行完程式後，a 和 b 的值各為多少？ (5%)

注意：背面有試題

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7. (15%) X(<u>A</u>,B,C,D) is a relational table where X is the table name. A, B, C, and D are the attributes each with 8 bytes long.   A is the primary key and the only candidate key.   In addition, there exists the following functional dependency:

A -> B, C, D

B -> D

甲、(5%) Which normal form(s) does Table X satisfy (1st NF, 2nd NF, 3rd NF, or others)? Why?

乙、(5%) Does further normalization needed for Table X to avoid anomaly? How and what normal form can we get?

丙、(5%) If there are 10000 rows in Table X, how much storage space can your answer in (b) save in maximum in the extreme case? Why? Please illustrate your answer for the extreme case.

8. (10%) Locking is used for concurrency control in the transaction processing for database systems.   Shared lock and exclusive locks are two kinds of locking.

甲、(5%) What are the difference when applying either shared lock or exclusive lock to a data item?

乙、(5%) The size of the locked data item can be small, such as a tuple or a record in a table; or big, such as a table or a database.   Please provide the pros and cons for applying locking to small and/or large sized data item.

9. (5%) In Java programing language, write a program to swap two numbers without using a third variable in your program.

10. (10%) Write a Java program to check if a given number is a prime number. Don't use Java's library to directly check for prime number, design your own solution. Your program needs to take an input number, and print out your answer with the input number.   Explain why your program is the most efficient one as efficiency and correctness are both graded for the question.