考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2月 6日(五) 第2節

Short-Answer Questions (100 points)

1. **(20 pts)** You are setting up a private testing lab within your office. You have connected your own router (acting as an Access Point/NAT/DHCP server) to the existing router in the office's infrastructure.
   - Office AP IP: 34.56.34.11 (Public/WAN facing)
   - Your AP's WAN IP: 192.168.50.11 (Assigned by the Office AP via DHCP)

   This setup creates a "Double NAT" environment where packets from your private network must traverse two different translation layers before reaching the Internet.

   1.1. (10 pts) A laptop connected to your private AP and was assigned an IP: 10.20.30.50. Suppose it sends a request to a public web server at 1.1.1.1. How are the packet headers translated as they pass through your AP and the Office AP? Please illustrate with a NAT Translation Table.

   1.2. (5 pts) Several laptops in your private network send requests to the same public web server. How does your private AP ensure that the server's responses are correctly routed back to the senders?

   1.3. (5 pts) Suppose that your private subnet is configured as 10.20.30.0/22. Calculate the total number of usable IP addresses available for client devices in this subnet.

2. **(15 pts)** What are the ACID properties in database transactions? Please illustrate with examples.

3. **(15 pts)** You want to upgrade a server for your company. There are two options: (1) upgrade the server so that its processing speed becomes k times faster; (2) replicate the server into k nodes; each node has the same processing speed as the original server. Compare the pros and cons of these two upgrade plans.

4. **(10 pts)** You are monitoring a sluggish server and find a sudden spike in page faults with heavy disk I/O.

   4.1. (4 pts) Describe what a page fault is and how an operating system typically handles it.

   4.2. (3 pts) Explain the concept of "thrashing" and how it affects system performance.

   4.3. (3 pts) What are page replacement algorithms, and how do they impact the frequency of page faults?

5. **(10 pts)** Suppose that a score-based binary classifier accepts an input x if $f(x) > c$, and rejects x otherwise. How does increasing the value of c affect the false positive rate and the false negative rate? Why?

6. **(10 pts)** Please explain the difference between the following three types of AI: chatbot, agent, and Copilot. Demonstrate how a user typically triggers each type of AI to complete a task.

7. **(20 pts)** An undirected graph is represented by an n x n Boolean matrix G, where G[x][y] = true if and only if the graph has an edge between vertices x and y, where $1 \le x,y \le n$. Design an efficient algorithm to find the *longest acyclic path* from vertex *1* to vertex n (15 pts), and explain why your algorithm is correct (5 pts).

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。