



注意事項：

1. 答案卷書寫題號依序作答，不必抄題，每題 10 分。
2. 答案卷不可書寫任何可辨別個人姓名或特殊標記，違反者以零分計算。
3. 請於試題紙上填寫准考證號，繳卷時「試題」、「答案卷」一併繳回。

1. What is a deadlock, and how can it be avoided? Discuss several deadlock-avoidance strategies.

2. Given the dependency diagram shown in Figure 1, answer Questions (a) through (c):

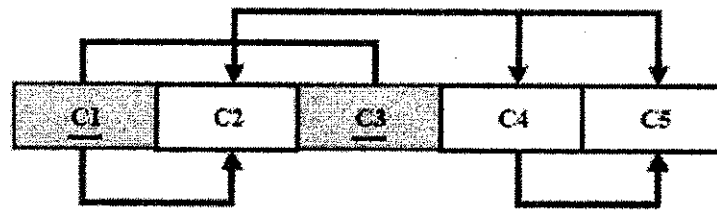


Figure 1. The Dependency Diagram for Question 2

- (a) Identify and discuss each of the indicated dependencies.
- (b) Create a database whose tables are at least in 2NF, showing the dependency diagrams for each table.
- (c) Create a database whose tables are at least in 3NF, showing the dependency diagrams for each table.

3. Suppose you are working within the framework of the conceptual model in Figure 2.

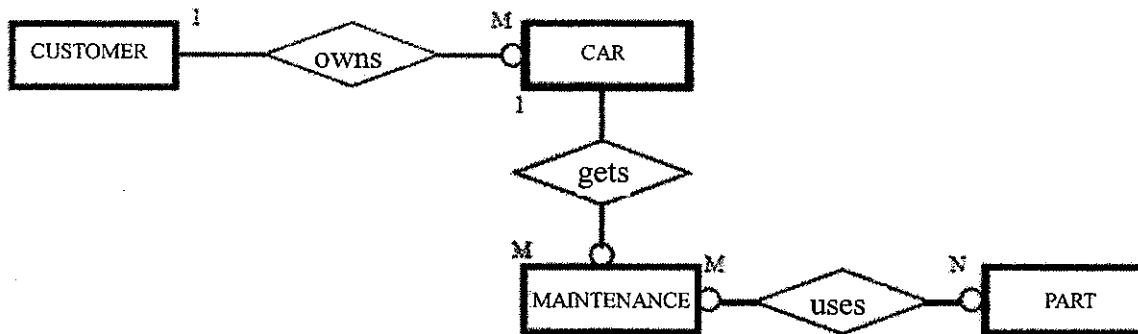


Figure 2. The Conceptual Model for Question 3

Given the conceptual model in Figure 2,

- (a) write the business rules that are reflected in it,
- (b) a weak relationship, and
- (c) a strong relationship.

4. Determine each of the following statements to be correct or not.

- (a) $5n^4 + 3n^2 = \Theta(n^4)$
- (b) $4n^{2.01} + 3n \log n = \Theta(n^{2.01})$
- (c) $5^n + 7 = O(3^n)$
- (d) $2n^3 + 3n^2 \log n = \Theta(n^2 \log n)$

5. It is assumed that we have the following key values in sequence: 30, 22, 18, 31, 25, 5, 10.

Write out the max heap after each value is inserted into the heap.

6. Please show that Kruskal's algorithm generates a minimum cost spanning tree.

7. Fill out the following form by using the Big-O notation:

	Space Complexity	Time Complexity
Insertion Sort		
Quick Sort		
Merge Sort		
Heap Sort		

8. Illustrate and explain the creation of a TCP connection by the three-way handshake.

9. What is the main advantage of using protocol ports instead of process identifier to specify the destination within a machine?

10. Design a Huffman code for a message source $S = \{s_1, s_2, s_3, s_4, s_5\}$ with the probabilities $p(s_1) = \frac{1}{2}$, $p(s_2) = \frac{3}{16}$, $p(s_3) = \frac{1}{8}$,

$p(s_4) = \frac{1}{8}$, $p(s_5) = \frac{1}{16}$. Calculate the average length of the code and compare it to the entropy of the source.