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國立臺北科技大學

九十三年度電機工程系博士班入學考試

計算機組 計算機理論試題

填准考證號碼

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注意事項：

1. 本試題共 12 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. (5%) Describe the differences between job scheduling and CPU scheduling.
2. Suppose that the following processes arrive for execution at the times indicated. Each process will run the listed amount of time.

Process	Arrival Time	Burst Time
P1	0	10
P2	1	5
P3	2	3
P4	3	1

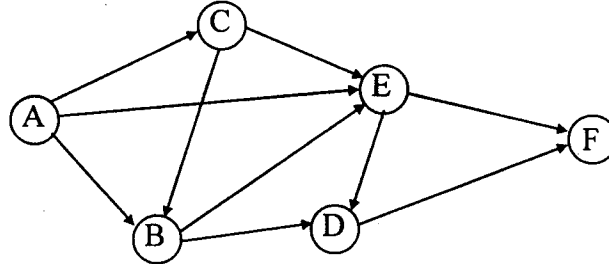
- (a) (5%) What is the average turnaround time for these processes with FCFS (First Come First Serve) scheduling algorithm?
 - (b) (5%) What is the average turnaround time for these processes with SRTF (Shortest Remaining Time First) scheduling algorithm?
3. (5%) What is the two-phase locking protocol?
 4. Consider the following representative page address trace generated by a two-level virtual memory that uses demand paging and has a main-memory capacity of **four** pages.

1 2 3 4 3 1 2 6 5 1 2 3

How many page faults would occur for the following replacement algorithms?

- (a) (5%) LRU replacement
- (b) (5%) FIFO replacement
- (c) (5%) OPT replacement

5. (5%) What is linked allocation in a file system? (5%) Can linked allocation have external fragmentation? Internal fragmentation?
6. (5%) Let A be a 3-dimensional array $A(I,J,K)$ and each element occupies one address. If the location of $A(1,2,3)$ is 109 and $A(3,3,2)$ is 192, then what is the location of $A(2,2,1)$.
7. (5%) Give a topological order for the following graph.



8. (5%) What is a heap? (5%) Show the heap of the key set {25, 40, 85, 10, 90, 60, 15}.
9. (10%) Transfer the following non-recursive program into a recursive program:
- ```

function odd_sum (N)
begin
 I ← 1; SUM ← 0;
 while (I ≤ N) do
 SUM ← SUM + I;
 I ← I + 2;
 end while
 return (SUM);
end

```
10. (5%) Obtain a nondeterministic algorithm of complexity  $O(1)$  to search for an element  $x$  in a given set of elements  $A(1:n)$ ,  $n \geq 1$ .
11. (5%) Describe the relationship among  $P$ ,  $NP$ ,  $NP$ -complete, and  $NP$ -hard problems?
12. A single server has  $n$  customers to server. The service time required by each customer is known in advance: customer  $i$  will take time  $t_i$ ,  $1 \leq i \leq n$ . We want minimize

$$T = \sum_{i=1}^n (\text{time in system for customer } i)$$

- (a) (5%) Given your Greedy Algorithm for scheduling.
- (b) (5%) Prove that this algorithm always yields an optimal solution.
- (c) (5%) How much time (use *big-O* notation) is required that accepts  $n$  and  $t(1:n)$  as data and produces an optimal schedule?