國立台灣科技大學九十九學年度碩士班招生試題

系所組別： 資訊工程系碩士班

科　　目： 資訊工程概論

（總分為100分）

※ 所有答案必須寫於答案卷內.

1. Please explain the following terminologies:
   (a) Belady's anomaly (5%)
   (b) Convoy effect (5%)
   (c) Race condition (5%)

2. Answer the following questions briefly.
   (a) Explain von Neumann architecture. (5%)
   (b) Explain the concept of RISC. (5%)
   (c) Explain how the number of stage of a pipeline may affect its throughput without considering the effect of all kinds of hazards? (5%)

3. Given a classic processor that uses flat 16-bit address space and is equipped with 64KB main memory and 1KB 2-way set associative cache with each block being 4 words long (1 word = 16 bits).
   (a) What is the bit length of the tag field in this cache? (10%)
   (b) At least how many bytes are necessary to implement this cache? (5%)
   (c) If words of the following word addresses 15, 16, 1030, 1031, 1032, 17, 45, 46, 4, 5, 260, 6, 1030, 1031 are read into the processor one-by-one, how many times would this cache hit and miss? Assume that the cache is empty at the beginning. (5%)

4. Consider the following set of processes with the length of the CPU burst given in milliseconds:

Process	Arrival Time	Burst Time	Priority
P_1	0	8	2
P_2	1	1	1
P_3	2	4	4
P_4	3	2	3

   (a) Draw five Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, preemptive SJF, preemptive priority (a smaller priority number implies a higher priority), non-preemptive priority, and RR (quantum = 1). (10%)

   (b) What is the turnaround time of P_4 for each of the five scheduling algorithms in part (a)? (5%)

   (c) What is the waiting time of P_3 for each of the five scheduling algorithms in part (a)? (5%)

國立台灣科技大學九十九學年度碩士班招生試題

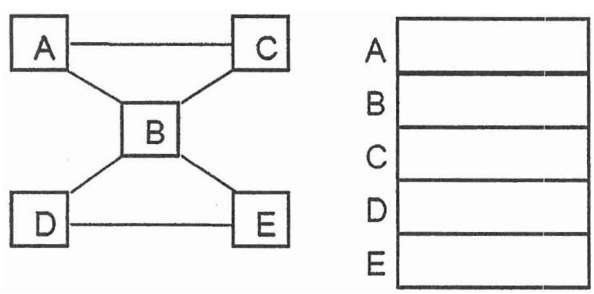
系所組別： 資訊工程系碩士班

科　　目： 資訊工程概論

（總分為100分）

5. Given a list of records (R_0, R_1, …, R_{n-1}) and given the following six sorting methods: (A) bubble sort (B) quick sort (C) heap sort (D) merge sort (E) radix sort (F) insertion sort.
   Note: Please answer the following questions by (A)(B)(C)(D)(E)(F) if possible.
   (a) Explain what is "stable" property for sorting algorithm. (2%)
   (b) Please list all the "stable" sorting algorithms among (A)(B)(C)(D)(E)(F). (2%)
   (c) Please list all sorting methods that have O(n log n) for time complexity in the "worst" case among (A)(B)(C)(D)(E)(F). (2%)

6. Consider the undirected graph shown below.



   (a) Complete the (traditional) adjacency lists representation for this undirected graph. Arrange each adjacency list alphabetically. (3%)
   (b) Please draw its depth-first search tree, starting at root node A (only show the discovery edges). Please consider the search path alphabetically. (3%)

7. Draw the final result after keys 5, 19, 28, 15, 20, 17, 10, 33 are inserted into a hash table with collisions resolved by (a) chaining (3%), (b) linear probing (3%). Assume the table has eight slots with its address starts at 0, and let the hash function be $h(k) = k \bmod 8$.

8. Express the running time of each code fragment as a θ function of n:

   (a) (3%)
```
for (a=1; a<=n; a++)
    for (b=1; b<=a; b++)
        C++;
```

   (b) (3%)
```
for (a=1; a<=n; a++)
    for (b=1;b<=a; b*=2)
        C++;
```

   (c) (3%)
```
for (a=1; a<=n; a*=2)
    for (b=1; b<=a; b++)
        C++;
```

   (d) (3%)
```
for (a=1; a<=n; a*=2)
    for (b=1; b<=a; b*=2)
        C++;
```