國 立 清 華 大 學 命 題 紙

95 學年度 通訊工程研究 系（所） 乙 組碩士班入學考試

科目 計算機系統 科目代碼 2503 共 3 頁第 1 頁 *請在【答案卷卡】內作答

1. (5%) Describe the differences between client-server and peer-to-peer models of distributed systems.
2. (5%) Describe the advantages of peer-to-peer model over client-server model.
3. (9%) Describe the differences among short-term, medium-term, and long-term scheduling.
4. (16%) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority
P_1	10	2
P_2	6	1
P_3	3	4
P_4	8	2
P_5	5	3

The processes are assumed to have arrived in the order P_1, P_2, P_3, P_4, P_5, all at time 0.

(a) Draw four Gantt charts illustrating the execution of these processes using the following scheduling algorithms: FCFS, SJF, nonpreemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1).

(b) What is the waiting time of each process for each of the scheduling algorithms in part (a)?

5. (10%) Assume the critical path of a new computer implementation is memory access for loads and stores. This causes the design to run at a clock rate of 500MHz instead of the target clock rate of 750MHz. What is the solution with minimum multi-cycle path to make the machine run at its targeted clock rate? Using the table shown below, determine how much faster of the approach used on the previous answer is compared with the 500 MHz machine with single-cycle memory access. Assume all jumps and branches take the same number of cycles and that the set instructions and arithmetic immediate instructions are implemented as R-type instructions.

Instruction class	Mix frequency	Cycles per instruction on 500MHz machine
Loads	22%	5
Stores	11%	4
R-Type	49%	4
Jmup/brach	18%	3

6. (10%) A C procedure that swaps two locations in memory is shown below:

```
swap( int v[], int k)
 { int temp;
        temp = v[k];
        v[k]=v[k+1];
        v[k+1]=temp;
    }
```

(a) Find the hazard in the following code from the body of the swap procedure.

(b) Reorder the instructions to avoid as many pipelines stalls as possible.

```
                                # reg $2 has the address of v[k]
lw    $15, 0($2)                # reg $15 (temp) = v[k]
lw    $16, 4($2)                # reg $16 = v[k+1]
sw    $16, 0($2)                # v[k] = reg $16
sw    $15, 4($2)                # v[k+1] = reg $15 (temp)
```

7. (10%) Bus A is a bus with separate 32-bit address and 32-bit data. Each transmission takes one bus cycle. A read to the memory incurs a three-cycle latency, then, starting with the fourth cycle, the memory system can deliver up to 8 words at a rate of 1 word every bus cycle. For a write, the first word is transmitted with the address; after a three-cycle latency up to 7 additional words may be transmitted at the rate of 1 word every bus cycle. Evaluate the bus assuming only 1 word requests where 60% of the requests are reads and 40% are writes. Find the maximum bandwidth that each bus and memory system can provide in words per bus cycle.
8. (13%)
   (a) Explain what a link state routing algorithm is.
   (b) What is the order of convergence speed?
   What is the order of messages exchanged in order to find a route?
   (c) What is a distance vector routing algorithm?
9. (10%)
   (a) Explain what the hidden node problem in wireless networks is.
   (b) Explain how the IEEE 802.11 protocol solves the hidden node problem.
10. (12%)
   (a) In a Mobile IP network, suppose a mobile node (with IP address 128.11.40.186) moves from its home network (subnet 128.119.40/24) to a visited network (subnet 79.129.13/24). Explain how the Mobile IP protocol handles packet delivery from a source node (with IP address 140.114.76.111) to this mobile node.
   (b) In a cellular network, how does the system connect a call from a desktop telephone to a cellular phone involving with HLR and VLR?