國立臺灣師範大學107學年度碩士班招生考試試題

科目：計算機系統　　適用系所：資訊工程學系

注意：1.本試題共 4 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

1. (4 分) Convert the following unsigned 8-bit binary numbers to decimal numbers:

   (a) (2 分) 00010001

   (b) (2 分) 10000010

2. (6 分) Consider a MIPS processor operating at the clock rate of 500 MHz. It executes a code sequence with 200 instructions. Suppose the Clock cycles Per Instruction (CPI) of the code sequence is 2.5.

   (a) (3 分) Find the clock cycle time of the MIPS processor (in ns).

   (b) (3 分) Find the CPU time for executing the code sequence (in ns).

3. (20 分) Assume a MIPS processor is pipelined with 5 stages (IF, ID, EX, MEM, WB). Moreover, the pipeline is associated with **hazard detection and data forwarding units.** The processor also includes separate instruction and data memories so that the structural hazard for memory references can be avoided.

   (a) (10 分) Consider the code sequence shown below. Identify all the data hazards which can be solved by forwarding. Determine the total number of clock cycles required for the execution of the code sequence.

```
ADD   R1, R4, R5;        R1 ← R4+R5
ADD   R2, R1, R8;        R2 ← R1+R8
SD    R2,16(R6);         MEM[16+R6] ← R2
```

(b)(10 分) Repeat part (a) for the following code sequence.

```
LD    R5, 64(R2);        R5 ← MEM[R2+64]
ADD   R10, R12, R5;      R10 ← R12+R5
ADD   R4, R10, R6;       R4 ← R10+R6
```

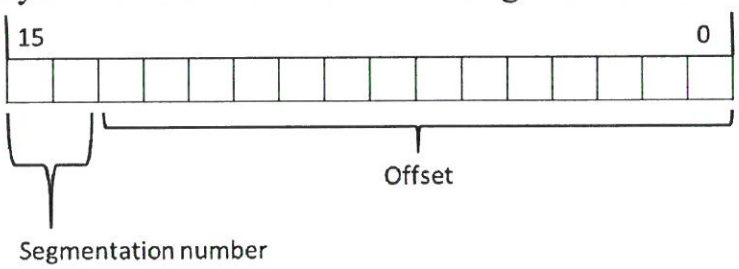
4. (10 分) Suppose the miss rate for accessing a cache is 0.05 misses per memory access. Assume the hit time is 1 clock cycle, and the miss penalty is 200 clock cycles. What is the Average Memory Access Time (AMAT) of the cache (in clock cycles)?

5. (10 分) Briefly explain the following terms:

(a) (5 分) Two-way Set Associative Cache,

(b) (5 分) Structural Hazard.

6. (10 分) Consider the following virtual address format and segmentation table. Determine the physical addresses for the following virtual addresses.



Segment	Base	Length
0	4000_{hex}	0800_{hex}
1	4800_{hex}	1400_{hex}
2	$F000_{hex}$	1000_{hex}
3	0000_{hex}	3000_{hex}

(a) (5 分) 0240_{hex}.
(b) (5 分) 4050_{hex}.

7. (10 分) Consider the following page reference string. Assume we use demand paging with three frames. Determine the number of page faults for the following replacement algorithms.

1 2 5 3 4 0 7 4 0 1 2 3 5 6 8 6 7 1 2 1

(a) (5 分) FIFO replacement.
(b) (5 分) LRU replacement.

8. (10 分) Consider the following processes. Determine the average waiting time of the execution for the following scheduling algorithms.

Process	CPU burst time	Arrival time
P1	8	0
P2	3	3
P3	6	2
P4	5	6

(a) (5 分) First-Come First-Served.
(b) (5 分) Round-Robin with time slice = 4 time units.

9. (10 分) Consider the following snapshot of a system. Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	2	0	0	1	4	2	1	2	3	3	2	1
P1	3	1	2	1	5	2	5	2				
P2	2	1	0	3	2	3	1	6				
P3	1	3	1	2	1	4	2	4				
P4	1	4	3	2	3	6	6	5				

10. (10 分) Illustrate a diagram to show the process states and state transitions in the lifecycle of processes.