國立中央大學資訊工程學系 103 學年度第二學期博士班資格考試題紙

科目：**計算機結構**（Computer Architecture）第一頁 共二頁（page 1 of 2）

1 (10%) Consider three different processors P1, P2, and P3 executing the same instruction set. P1 has a 3 GHz clock rate and a CPI of 1.5. P2 has a 2.5 GHz clock rate and a CPI of 1.0. P3 has a 4.0 GHz clock rate and has a CPI of 2.2.

(a) Which processor has the highest performance expressed in instructions per second?

(b) If the processors each execute a program in 10 seconds, find the number of cycles and the number of instructions.

(c) We are trying to reduce the time by 30% but this leads to an increase of 20% in the CPI. What clock rate should we have to get this time reduction?

2 (10%) The information of a virtual memory system is assumed to be:

- Page size: 1024 words
- Number of virtual pages: 8
- Number of physical pages: 4
- The current page table is

VPN	0	1	2	3	4	5	6	7
PPN	2	1	NULL	NULL	3	NULL	0	NULL

For the following (decimal) virtual word addresses: VA1: 57, VA2: 2048, VA3: 1025, VA4: 7748, VA5 6152, Please calculate their physical addresses are PA1, PA2, PA3, PA4, PA5.

3 (10%) A cache with data size 1Mbytes contains 16384 blocks and is four way set associative. The address 0x11D9A4F3 is accessed and is a hit in this cache. What is the corresponding tag value?

4 (10%) Given cache, TLB, page table, main memory and the secondary storage (disk), describe the process of a memory access in a systematical way.

5 (10%) Can we keep pursuing the increase of clock rate of processors to improve the performance? Please describe your reasons.

6 (10%) What is Loop Unrolling when exploiting instruction level parallelism? What are the advantages? Explain it clearly by an example.

背面還有 Please Turn Over

7 (15%) How does scoreboard deal with WAR, RAW, and WAW hazards? At which stage respectively?

8 (10%) What are the assumptions or hypothesis of a correlating branch predictor? How does it work?

9 (15%) Assume data reference: 25%, and there is only one memory port. Processor with structural hazard (Processor A) has a clock rate 1.2 times higher than the clock rate of the processor without the structural hazard (Processor B). Discard any other performance losses. Which processor is faster? How much faster?