

考試 時間	月 (星期)	日上午 下午第 晚間	節	份數	任課 教師
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國立臺灣科技大學

99學年度第 一 學期 博士班 考試命題用紙

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考試科目: *Computer Architecture*

- 研究所
 大學部
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1. Please define functionalities of the compiler, the assembler, the linker, and the loader, respectively. (16%)
2. (a) What are disadvantages of the static approach to linking libraries before the program is run? (6%)
 (b) What is the main idea of dynamically linked libraries (DLLs)? (3%)
 (c) What is the main idea of the lazy procedure linkage version of DLLs? (3%)
3. Given the following MIPS assembly code:

```

X: addi    $sp,$sp,-8      # adjust stack for 2 items
   sw     $ra,4($sp)      # save the return address
   sw     $a0,0($sp)      # save the argument n
   slti   $t0,$a0,1
   beq    $t0,$zero,L1
   addi   $v0,$zero,1
   addi   $sp,$sp,8       # pop 2 items off stack
   jr     $ra
L1: addi   $a0,$a0,-1
   jal    X
   lw     $a0,0($sp)
   lw     $ra,4($sp)
   addi   $sp,$sp,8       # adjust stack pointer
   mul    $v0,$a0,$v0
   jr     $ra
  
```

The parameter variable n corresponds to the argument register $\$a0$.

- (a) What do the letters MIPS stand for? (3%)
- (b) Please explain how a stack works. (4%)
- (c) Please explain how the "set on less than" instruction (slt) works. (3%)
- (d) Please explain how the "jump register" instruction (jr) works. (3%)
- (e) Please explain how the "jump-and-link" instruction (jal) works. (3%)
- (f) What does the MIPS assembly code do? Please rewrite it with high-level language. (6%)

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99學年度第 \rightarrow 學期 ^{博七列考} _{資格考} 試命題用紙

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4. You are going to enhance a machine, and there are two possible implementations: either making multiply instructions run 4 times faster than before, or making memory access instructions run 2 times faster than before. You repeatedly run a program that takes 100 seconds to execute. Of this time, 20% is used for multiplication, 50% for memory access instructions, and 30% for other tasks.

(a) What will the speedup be if you improve only multiplication? (5%)

(b) What will the speedup be if you improve only memory access? (5%)

(c) What will the speedup be if both implementations are made? (5%)

5. 1-bit ALU

(a) Design a 1-bit half adder (4%)
i.e. write down the logical equations (or truth table) of Sum and CarryOut and then design the hardware for Sum and CarryOut

(b) Design a 1-bit full adder (4%)

(c) Design a 1-bit ALU that performs AND, OR, and addition operations (4%)

(d) Does the ALU need a subtractor? Why? (4%)

(e) Please modify the 1-bit ALU to handle subtraction. (4%)

6. Dependences and hazards

(d) What are the three different types of dependences? Explain each type of dependences (6%)

(e) What types of pipeline hazards might be caused by each type of dependences? (9%)