院系 College	工 學院 工科 系三年 班 College Department Year Class	評閱成績 Score	97 97	of Instructor	

1. (A) False (F) False
(B) True (G) False
(C) True (H) False
(D) True (I) False
(E) True (J) True

+27

2.
die area = 0.4 cm², defects per cm² = 4

$$\text{yield} = \frac{1}{(1+4\times0.4\div2)^2} = 30.86\%$$

+8

die area = 0.4 cm², defects per cm² = 4÷2 = 2

$$\text{yield} = \frac{1}{(1+2\times0.4\div2)^2} = 51.85\%$$

3.
Computer A: CPI = 1.3, clock rate = 600 MHz
Computer B: CPI = 2.5, clock rate = 750 MHz

Execution time A = $1.3\times100000\div(600\times10^6)$
$= 2.167\times10^{-4}$

Execution time B = Execution time A
$= 2.5\times$ instruction count $\div(750\times10^6)$

+4

$$\text{instruction count} = \frac{\text{Execution time A}}{2.5\div(750\times10^6)}$$
$= 65000$

4.
arithmetic instructions:
CPI = 1, instruction count = 500×10^6

load/store instructions:
CPI = 10, instruction count = 300×10^6

branch instructions
CPI = 3, instruction count = 100×10^6

(A) Assume clock cycle time = 1

Original execution time
$= (1\times500\times10^6 + 10\times300\times10^6 + 3\times100\times10^6)\times1$
$= 3800\times10^6$

with new arithmetic instructions:
clock cycle time = $1\times1.1 = 1.1$
execution time
$= (1\times500\times10^6\times0.95 + 10\times300\times10^6 + 3\times100\times10^6)\times1.1$
$= 4042.5\times10^6$

+6

不是好選擇，因為執行時間比原本還長。

(B)
Assume clock cycle time = 1
Double the performance of arithmetic instructions:
CPI = 0.5
execution time
$= (0.5\times500\times10^6 + 10\times300\times10^6 + 3\times100\times10^6)\times1$
$= 3550\times10^6$
overall speedup = $3800\times10^6\div(3550\times10^6) = 1.07\times$

10x performance of arithmetic instructions:

+4

CPI = 0.1
execution time
$= (0.1\times500\times10^6 + 10\times300\times10^6 + 3\times100\times10^6)\times1$
$= 3350\times10^6$
overall speedup = $3800\times10^6\div(3350\times10^6) = 1.13\times$

5. beq, bne. +2

先將指令內的參數 address 左移 2 bits，再將左移後的值加上 PC+4，即可得到要 branch 的目標位址，再跳到目標位址繼續執行程式。 +6

其他在後面

6. $a0: int *a , $a1: int h

```
    addi $sp, $sp, -4
    sw $s0, 0($sp) # int f;
    slt $t0, $a1, $zero # h<0: $t0=1, h>=0: $t0=0
    bne $t0, $zero, else # if(h>=0), branch if $t0≠$zero
    lw $t1, 40($a0) # a[10]
    add $t1, $t1, $a1 # a[10]+h
    add $s0, $t1, $zero # f=a[10]+h
    j exit # exit if()
else: lw $t1, 40($a0) # a[10]
    sub $t1, $t1, $a1 # a[10]-h
    add $s0, $t1, $zero # f=a[10]+h
exit: add $v0, $s0, $zero # return f
    lw $s0, 0($sp)
    addi $sp, $sp, 4
    jr $ra # procedure return
```

stack: +4
if-else: +4
Exit: +4

7.
(A) $19 = 0x30
$17 = 0x30
$20 = 0x20 + 0x10 = 0x30
memory 0x28 = 0x30

(B) $1 = 0x60
$2 = 0x50

(C) YES

+12

8.
(A) 0x22512A52

(B) 11Q*R

(C) addi $s1, $s2, 10834

(D) $s1, 10885

+16