國 立 交 通 大 學 105 學 年 度 碩 士 班 考 試 入 學 試 題

科目：計算機概論(5081)
系所班別：資訊管理與財務金融學系　　組別：資管碩乙組

考試日期：105 年 2 月 2 日　第 2 節
第 1 頁，共 3 頁

【不可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

1. (9%) How many different binary trees are possible with 5 unique nodes?

2. (10%) A system with four page frames receives a reference string (sequence of pages that are requested): 123412512345. If all of the frames are initially empty, calculate the number of page faults using the following page replacement algorithms: (1) First-in, first out; FIFO (2) Least recently used; LRU.

3. (10%) In the page-table scheme, every data/instruction access requires two memory accesses. Use effective access time (EAT) to compare the time consumption with and without translation look-aside buffer (TLB) under the following system settings. TLB lookup time = 5 ns TLB hit ratio = 80% Memory access time = 100 ns

4. (5%) Convert the hexadecimal number 0xA17C to binary and decimal.

5. Use the appendix for this problem. Suppose the following program is stored in main memory beginning at address 30 (hexadecimal).

```
2003
2101
2200
2310
1400
3410
5221
5331
3239
333B
B248
B038
C000
```

When executed: (Explain what the program does as a unit rather than reciting what each instruction does.)
a. (4%) What task will the program perform "before" the execution of the conditional JUMP B038 for the 1st time?
b. (4%) What task will the program perform "after" the execution of the conditional JUMP B038 for the 1st time and "before" the execution of the conditional JUMP B038 for the 2nd time?
c. (4%) What task will the program perform "after" the execution of the conditional JUMP B038 for the 2nd time and before reaching the HALT?

6. (7%) Let f(n)=2f(n-1)+1 be a recurrence function of n for f(1)=1. If f(n)=Θ (g(n)), derive g(n).

7. Given the three relations X, Y, and Z below

```
X: A B    Y: C D    Z: E F
   7 s       t 4       1 w
   5 z       r 2       3 s
   1 u
```

a. (7%) What values would be retrieved by executing the following statement?

```
SELECT X.B, Y.C, Z.F
FROM X, Y, Z
WHERE X.A < Y.D AND X.A = Z.E
```

b. (7%) Rewrite the following sequence of SELECT, PROJECT, and JOIN operations as a SQL statement.

```
Temp1  ←  JOIN X and Z where X.B = Z.F
Temp2  ←  SELECT from Temp1 where X.A > Z.E
Result ←  PROJECT X.B and Z.F from Temp2
```

8. (5%) Suppose is a three-bit binary number and fed into the following circuit with going into the lower line, going into the middle line, and going into the upper line. Please determine the range of in base 10 notation which will produce an output of 1 in this circuit.
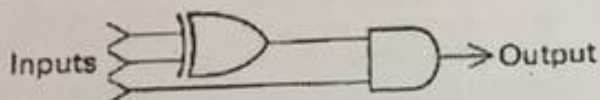
9. Suppose a multiprogramming operating system is allotting time slices of 100 milliseconds. If it normally takes 10 milliseconds on average to position a disk's read/write head over the desired track and assume that the rotational speed of disk is 3000 revolutions per minute (rpm), how much of a program's time slice on average should be spent waiting for a read operation from a disk to take place? (3%) If the machine is capable of executing 50 instructions each nanosecond, how many instructions can be executed during this waiting period? (3%) Suppose each track in the hard disk contains 16 sectors and each sector contains 1024 bytes. If a process is going to transfer a file with 540 KB from disk to main memory and assume that the communication rate is much higher than the reading rate, no other operations may interfere with this process, and all data are stored in a consecutive block of hard disk (i.e., time for moving read/write head between the neighboring tracks is negligible), with how many time slices will this process be indicated as waiting in the process table for this reading operation by scheduler most of the time? (5%)

10. What is the results of performing a two-bit right circular shift on each of the following bytes, DA and 29, which are represented in hexadecimal notation and then adding them up in binary form? Ignore the carry if any and please answer in binary form. (3%)
What is the results of performing a one-bit left circular shift on each of the following bytes, 4B and C1, which are represented in hexadecimal notation and then adding them up in binary form? Ignore the carry if any and please answer in base 10 form. (3%)

11. (3%) For programming languages that use + to mean concatenation of character strings, what result will the expression "7a" + "2a" produce?

12. Suppose B is a global variable and the function Testforpass is defined as follows.

```
def Testforpass (A):
A = 3
print(A)
print(A + B)
```

If parameters are passed by value, what will be printed when the following program is executed? (4%) What if parameters are passed by reference? (4%)

```
B = 7
Testforpass(B)
print(B)
```

Appendix
This "language description table " in the following problem is for problem 5.

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY. *Example:* 14A3 would cause th contents of the memory cell located at address A3 to be placed in register 4.

2 RXY　LOAD the register R with the bit pattern XY.
Example: 20A3 would cause the value A3 to be placed in register 0.
3 RXY　STORE the bit pattern found in register R in the memory cell whose address is XY.
Example: 35B1 would cause the contents of register 5 to be placed in the memory cell whose address is B1.
4 0RS　MOVE the bit pattern found in register R to register S.
Example: 40A4 would cause the contents of register A to be copied into register 4.
5 RST　ADD the bit patterns in registers S and T as though they were two's complement representations and leave the result in register R.
Example: 5726 would cause the binary values in registers 2 and 6 to be added and the sum placed in register 7.
6 RST　ADD the bit patterns in registers S and T as though they represented values in floating-point notation and leave the floating-point result in register R.
Example: 634E would cause the values in registers 4 and E to be added as floating-point values and the result to be placed in register 3.
7 RST　OR the bit patterns in registers S and T and place the result in register R.
Example: 7CB4 would cause the result of ORing the contents of registers B and 4 to be placed in register C.
8 RST　AND the bit patterns in register S and T and place the result in register R.
Example: 8045 would cause the result of ANDing the contents of registers 4 and 5 to be placed in register 0.
9 RST　EXCLUSIVE OR the bit patterns in registers S and T and place the result in register R.
Example: 95F3 would cause the result of EXCLUSIVE ORing the contents of registers F and 3 to be placed in register 5.
A R0X　ROTATE the bit pattern in register R one bit to the right X times. Each time place the bit that started at the low-order end at the high-order end.
Example: A403 would cause the contents of register 4 to be rotated 3 bits to the right in a circular fashion.
B RXY　JUMP to the instruction located in the memory cell at address XY if the bit pattern in register R is equal to the bit pattern in register number 0. Otherwise, continue with the normal sequence of execution. (The jump is implemented by copying XY into the program counter during the execute phase.)
Example: B43C would first compare the contents of register 4 with the contents of register 0. If the two were equal, the pattern 3C would be placed in the program counter so that the next instruction executed would be the one located at that memory address. Otherwise, nothing would be done and program execution would continue in its normal sequence.
C 000　HALT execution.
Example: C000 would cause program execution to stop.

✓ 1. 4^2

2. FIFO: 10

   LRU: 8

3.

4. binary: 1010 0001 0111 1100

   Decimal: 41340

A17C

$10 \times 16^3 + 16^2 +$

5.

6.

11. 7a2a

a.

7.

B	C	F
u	t	w
u	r	w

12.

pass by value 3, 10, 7

pass by ref. 3 6 3

b. S S

8.
U	1	0
M	0	1
L	1	1

9.

10. '(0000 0000)₂

2. (25)₁₀