

## 國立臺灣科技大學 111 年度產業碩士專班招生(秋)試題

專 班 別：AI 跨域應用、大數據分析及資訊安全

科 目：計算機概論

( 總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分 )

不得使用計算器

## 1. (20 points)

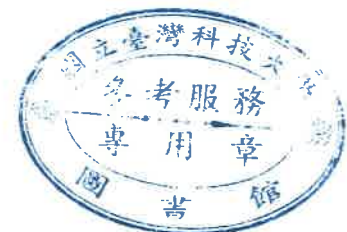
Translate the following instructions from English into the machine language described in the appendix.

- (a) LOAD register 6 with the hexadecimal value 77.
- (b) LOAD register 7 with the contents of memory cell 77.
- (c) JUMP to the instruction at memory location 24 if the contents of register 0 equals the value in register A.
- (d) ROTATE register 4 three bits to the right.
- (e) AND the contents of registers E and 2, leaving the result in register 1.

## 2. (12 points)

The table below represents a tree stored in a machine's memory. Each node of the tree consists of three cells. The first cell contains the data (a letter), the second contains a pointer to the node's left child, and the third contains a pointer to the node's right child. A value of 0 represents a null pointer. Assume that the value of root pointer is 55, draw a picture of the tree.

| Address | Contents |
|---------|----------|
| 40      | G        |
| 41      | 0        |
| 42      | 0        |
| 43      | X        |
| 44      | 0        |
| 45      | 0        |
| 46      | J        |
| 47      | 49       |
| 48      | 0        |
| 49      | M        |
| 50      | 0        |
| 51      | 0        |
| 52      | F        |
| 53      | 43       |
| 54      | 40       |
| 55      | W        |
| 56      | 46       |
| 57      | 52       |



## 國立臺灣科技大學 111 年度產業碩士專班招生(秋)試題

專 班 別：AI 跨域應用、大數據分析及資訊安全  
科 目：計算機概論

( 總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分 )

不得使用計算器

3. (16 points)

(1) Which of the following tasks is/are handled by a database management system? (6 points)

- Ensure that a user's access to the database is restricted to the appropriate subschema.
- Translate commands stated in terms of the database model into actions compatible with the actual data storage system.
- Disguise the fact that the data in the database is actually scattered among many computers in a network.

(2) On the basis of the database presented below, what values would be retrieved by executing the following SQL statements? (10 points)

```
SELECT Assignment.JobId, Employee.Salary
```

```
FROM Assignment, Employee
```

```
WHERE Assignment.EmplId = Employee.EmplId
```

```
AND Employee.Name = 'Whalen';
```

| Assignment |       |           |
|------------|-------|-----------|
| EmplId     | JobId | StartDate |
| 25X15      | 33    | 7-6-2012  |
| 23Y34      | 15    | 3-1-2010  |
| 34Y70      | 22    | 5-21-2009 |

| Employee |        |        |
|----------|--------|--------|
| EmplId   | Name   | Salary |
| 23Y34    | Boss   | 27000  |
| 25X15    | Rajs   | 22000  |
| 23Y34    | Whalen | 35000  |



## 國立臺灣科技大學 111 年度產業碩士專班招生(秋)試題

專班別：AI 跨域應用、大數據分析及資訊安全  
科目：計算機概論

(總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分)

不得使用計算器

4. (10 points)

Sort the following terms of time complexity from the fastest one to the slowest one.

$\Theta(n^2)$ ,  $\Theta(\log_2 n)$ ,  $\Theta(2^n)$ ,  $\Theta(n)$ ,  $\Theta(n!)$

5. (9 points)

Use operations push, pop, and no-op (i.e., forward the input to the output directly) to rearrange an input sequence. For six numbers 1, 2, 3, 4, 5, 6 entered in that order, which of the following rearrangements is/are not possible?

(a) 235146    (b) 325641    (c) 154623

6. (9 points)

Suppose the following options have been proposed for removing the deadlock that occurs on a single-lane bridge when two cars meet. Identify which of these options is/are able to remove the deadlock problem.

- (a) Do not let a car onto the bridge until the bridge is empty.
- (b) If cars meet, make one of them back up.
- (c) Add a second lane to the bridge.



## 國立臺灣科技大學 111 年度產業碩士專班招生(秋)試題

專 班 別：AI 跨域應用、大數據分析及資訊安全  
科 目：計算機概論

( 總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分 )

不得使用計算器

7. (14 points)

Match each of the following internet software layers with its corresponding open system interconnection (OSI) layer(s).

- a. Application
- b. Transport
- c. Network
- d. Link

- (1) Network
- (2) Data Link
- (3) Presentation
- (4) Session
- (5) Physical
- (6) Transport
- (7) Application

8. (10 points)

Convert each of the following base 10 representations to its equivalent two's complement or excess thirty-two format representation. Note that each value should be represented in 8 bits.

- (a) -27 (to **two's complement** format)
- (b) 29 (to **excess thirty-two** format)



## 國立臺灣科技大學 111 年度產業碩士專班招生(秋)試題

專班別：AI 跨域應用、大數據分析及資訊安全  
 科目：計算機概論

( 總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分 )

不得使用計算器

## Appendix

| Op-code | Operand | Description   |
|---------|---------|---|
| 1       | RXY     | LOAD the register R with the bit pattern found in the memory cell whose address is XY.<br><i>Example:</i> 14A3 would cause the 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.<br><i>Example:</i> 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.<br><i>Example:</i> 35B1 would cause the contents of register 5 to be placed in the memory cell whose address is B1.   |
| 4       | ORS     | MOVE the bit pattern found in register R to register S.<br><i>Example:</i> 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.<br><i>Example:</i> 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.<br><i>Example:</i> 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.<br><i>Example:</i> 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 registers S and T and place the result in register R.<br><i>Example:</i> 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.<br><i>Example:</i> 95F3 would cause the result of EXCLUSIVE ORing the contents of registers F and 3 to be placed in register 5.  |
| A       | ROX     | 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.<br><i>Example:</i> 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.)<br><i>Example:</i> 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.<br><i>Example:</i> C000 would cause program execution to stop.  |

