

## I. Multiple Choice – 單選題 (50 %)

- ( ) 1. The \_\_\_\_ unit is used to fetch, decode, and execute instructions.  
(A) Memory (B) I/O (C) ALU (D) Control (E) Disk
- ( ) 2. In a machine language instruction operation code takes 10 bits. What is the maximum number of distinct operation codes that can be recognized and executed by the processor on this machine?  
(A) 10 (B) 80 (C) 1024 (D) 512 (E) 256
- ( ) 3. A memory unit is organized as a 1,024 x 1,024 two dimensional array. What is the size of MAR?  
(A) 20 bits (B) 21 bits (C) 2048 bits (D) 1 Mbits (E) 2048 Bytes
- ( ) 4. The system boots its OS from \_\_\_\_.  
(A) FAT (B) MBR (C) Root folder (D) System sector (E) Power
- ( ) 5. \_\_\_\_ is needed for a code of 100 instructions to run at a machine of 100 MIPS.  
(A) 1  $\mu$ s (B) 1 ms (C) 1 ns (D) 10 ns (E) 10 ms
- ( ) 6. The \_\_\_\_ operations alter the normal sequential flow of control.  
(A) Arithmetic (B) Branch (C) Compare (D) Data transfer (E) Extra
- ( ) 7. The \_\_\_\_ stores the address of a memory location.  
(A) PC (B) IR (C) IP (D) MAR (E) MDR
- ( ) 8. \_\_\_\_ operation codes are restricted to be used in the operating system or other system software.  
(A) User (B) System (C) Privileged (D) Specialized (E) Software
- ( ) 9. The \_\_\_\_ operation complements the value of a Boolean expression.  
(A) AND (B) OR (C) NOT (D) XOR (E) NOR
- ( ) 10. What is the bytes for 4 minutes song sampled 10,000 times per second with the bit depth of 16?  
(A)  $48 \times 10^5$  (B)  $36 \times 10^5$  (C)  $64 \times 10^4$  (D)  $24 \times 10^5$  (E)  $384 \times 10^5$
- ( ) 11. Use 8-bit to represent the integer  $(-57)_{10}$  in two's complement.  
(A)  $(11000110)_2$  (B)  $(11000111)_2$  (C)  $(10011001)_2$  (D)  $(10111001)_2$  (E)  $(00111001)_2$
- ( ) 12. Convert decimal number 100.625 to its binary representation.  
(A) 100.101 (B) 10001.101 (C) 10001.11 (D) 1100100 (E) 1100100.101
- ( ) 13. Convert hexadecimal number 2E.4 to its decimal representation.  
(A) 101101.01 (B) 101101.1 (C) 64.25 (D) 46.25 (E) 2E.4
- ( ) 14. Which is a multiple selection in C language?  
(A) if ... else (B) repeat (C) while (D) switch (E) main
- ( ) 15. Which statement will cause a syntax error in C language?  
(A) `int i = "I";` (B) `char ch = 'X';` (C) `float a = 2/5;` (D) `int x = 0;` (E) none of the above
- ( ) 16. Which statement in C language is valid?  
(A) `**p++ - *p;` (B) `++p*-- + *p;` (C) `--*p * *p++;` (D) `++p*-- - *p;` (E) none of the above
- ( ) 17. In the \_\_\_\_ topology, all nodes connected to a single shared communication line.  
(A) Star (B) Bus (C) Ring (D) Mesh (E) Circle
- ( ) 18. What is the time of the disk for beginning of the desired sector to rotate under the read/write head?  
(A) Seek time (B) Transfer time (C) Disk time (D) Frequency (E) Latency
- ( ) 19. The \_\_\_\_ layer protocols can be thought of as creating an error-free message pipe, in which messages go in one end and always come out the other end correct and in the proper order.  
(A) Physical (B) Data link (C) Network (D) Transport (E) Application

- ( ) 20. When we use more bits to represent a floating-point number in computers, which of the following statements is incorrect?  
 (A) Smaller number can be represented. (B) More truncation error can be represented.  
 (C) Larger number can be represented. (D) More precise number can be represented.  
 (E) None of the above
- ( ) 21. How many times will the following program print Hi? for (i = 2; i < 2000; i \*= 3) printf("Hi!");  
 (A) 5 (B) 6 (C) 7 (D) 8 (E) none of the above
- ( ) 22. The maximum number of comparisons needed for the binary search of a 2000 element array is:  
 (A) 9 (B) 15 (C) 11 (D) 14 (E) none of the above
- ( ) 23. What value does the function call fun(4) return?  

```
int fun (int n) {
    if (n < 1) return 1;
    else return fun(n - 1) + n * n;
}
```

 (A) 30 (B) 31 (C) 55 (D) 56 (E) none of the above
- ( ) 24. Which abstract data type is last in and first out?  
 (A) Hash (B) Stack (C) Linked list (D) Queue (E) Tree
- ( ) 25. Which tree is widely used in file systems?  
 (A) AVL tree (B) B\*-tree (C) R-tree (D) T-tree (E) None of the above

## II. Questions and Answers – 問答題 (50 %)

- (12%) Explain the following terms: (1) Android (2) Cloud computing (3) Heap (4) Splay tree
- (8%) Consider the following two programs and write what will be printed.

(1)

```
main() {
    int i = 3;
    while(i > 0)
        if (fork() > 0) printf("In parent %d.\n", i--);
        else{
            printf("In child %d.\n", i);
            exit(0);
        }
}
```

(2)

```
int sub (int *a, int *b) {
    *b *= 2;
    printf("a = %d, b = %d.\n", *a, *b);
    return --*a * *b++;
}
main() {
    int x = 2, y = 3;
    y = sub(&x, &x);
    printf("x = %d, y = %d.\n", x, y);
}
```

3. (10%) Write a program to read n and generate all subsets of {1, 2, ..., n}. A possible run may look like:

```
Enter n: 3
{1}
{2}
{3}
{1, 2}
{1, 3}
{2, 3}
{1, 2, 3}
```

4. (10 %) Create a structure to present a polynomial term and then use an array of this structure to represent a polynomial. For example,  $x^2 - 4x + 7$  is a polynomial. Write a function that passes a polynomial and x and returns the value of the polynomial.

5. (10%) Fill the time complexity for the following sorting algorithms.

Sorting Method	Time complexity		
	Best	Average	Worst
Bubble sort			
Heap sort			
Merge sort			
Quick sort			