

1. (3%) What is "call by value?"
2. (3%) What is "call by reference?"
3. (3%) What is the advantage of compiled programming languages compared with interpreted languages?
4. (8%) Compare the advantage and disadvantage of array v.s. linked list.
5. (8%) Consider the following sorting algorithms: bubble sort, merge sort, insertion sort, and quick sort. What is the time complexity of each algorithm?
6. (5%) Write down the output of the following C program.

```
#include<stdio.h>
int main()
{
    for(int i=10;i<=15;i++){
        if(i%2)
            if(i%3)
                printf("0");
        else
            printf("1");
    }
    return 0;
}
```

7. (5%) Write down the output of the following C program

```
#include <stdio.h>
int x=1;
int func(int x){
    return ++x;
}
int main(void){
    printf("%d\n", func(x));
    printf("%d\n", x++);
    return 0;
}
```

8. (5%) Write down the output of the following C program

```
void main()
{
    int s[5]={1, 3, 5, 4, 2};
    int *p=s, *ptr=s+3;
    printf("A:%d\n", *p+1);
    printf("B:%d\n", *ptr);
    printf("C:%d\n", s[0]);
    printf("D:%d\n", *p++);
    printf("E:%d\n", *p);
}
```

9. (5%) Write down the output of the following C program

```
#include <stdio.h>
int main()
{
    int array[3][3]={ {1,2,3}, {4,5,6}, {7,8,9} };
    int i, j, k=0;
    for(i=0;i<3;i++){
        for(j=i;j<3;j++){
            k += array[i][j];
        }
    }
    printf("%d\n", k);
    return 0;
}
```

(5%)

10. Write down the output of the following C program.

```
#include <stdio.h>
int sum(int n)
{
    if(n==1)
        return 1;
    else if(n==2)
        return 4;
    else
        return 2*sum(n-1) + n - sum(n-2);
}
int main()
{
    printf("%d\n", sum(4));
    return 0;
}
```

11. (50%; each 5 %) The main memory is byte-addressable and CPU is going to access the following 12 addresses: 8, 20, 182, 88, 39, 40, 98, 182, 57, 32, 66, 88 (in decimal).

- (a) Assume CPU uses these addresses to read 12 8-bit (1-byte) variables, and a direct-mapped cache exists between CPU and main memory. If the cache has 10 blocks, each of which can only hold 1-byte data, which is the first read access that has a “cache hit”?
- (b) What is the total number of cache misses for the 12 read accesses in (a)?
- (c) How many cache misses in (b) are compulsory misses?
- (d) How many cache misses in (b) are capacity misses?
- (e) How many cache misses in (b) are conflict misses?
- (f) If each cache block in (a) can hold 10-byte data (i.e. the block size becomes 10-byte), which is the first read access that has “a cache hit”?
- (g) What is the total number of cache misses for the 12 read accesses in (f)?
- (h) How many cache misses in (g) are compulsory misses?
- (i) How many cache misses in (g) are capacity misses?
- (j) How many cache misses in (g) are conflict misses?