# 1101 NTOUCSE 程式設計 1C 期中考

姓名：_____ 系級：_____ 學號：_____ 110/11/16 (二)

考試時間：**13:20 – 16:00**

Exam rules：
1. **Close book**, **close** everything including quizs, homeworks, assignments, reference materials, etc.
2. You can answer the questions in **English** or in **Chinese**, in this **problem sheet**, the **answer sheet**, or **both**.
3. You can use language features not taught in class if you feel necessary, but strictly limited in C or C++.
4. **No** mobile phone, pad, computer or calculator is allowed. (Electronic) English dictionary is OK
4. No peeping around! No discussion! No exchange of any material; **raise your hand if you have any question about the exam problems**
5. If you turn in the paper earlier than the specified time, **leave the classroom immediately and quietly**
6. Against any of the above rules will be treated as cheating in the exam and handled by school regulations.
7. **Turn in BOTH the signed problem sheet and signed answer sheet**.

1. Please point out and correct the syntax or semantic errors in the following program segments

(a) [3] The following program segment wishes to input a 0~9 character from the keyboard and converts to its corresponding integer value. However, it does not work correctly. Please correct this segment.

```
01 int num=-1, ch=getchar();
02 if ('9' >= ch >= '0') num = ch – '0';
```

(b) [3] How do you modify the following program segment such that x=0, total=55 are printed out?

```
01 int x = 10, total;
02 while (x = 0)
03 {
04        total += x;
05        x-=1;
06 }
07 printf("x=%d, total=%d\n", x, total);
```

(c) [3] During the execution of the following program segment, there is no output shown on the screen. Please modify it such that sum=55 is shown on the screen.

```
01 sum=0, i=0;
02 while (i<=10)
03        sum += i;
04        i++;
05 printf("sum=%d\n", sum);
```

(d) [3] What will be the strange output when the following program segment is executed? How do you correct it?

```
01 int i=1, x=1;
02 while (i++<=16)
03        x*=i;
04 printf("%d\n", x);
```

2. Please finish the following program according to the problem descriptions. This is supposed to be a program input a decimal string at most 100 digits and check if it is a multiple of eleven. It it is, the function returns 1 and 0 otherwise.

```
01  #include <stdio.h>
02  int isMultipleOf11(_________________)
03  {
04        int sum=0, i;
05        for (i=0; _____________; i++)
06              sum += (i%2*2-1) * (___________);
```

```
07      return _____==0;
08  }
09  int main()
10  {
11      char num[101];
12      while (1==scanf("_____", num))
13          printf("%d\n", isMultipleOf11(num));
14      return 0;
15  }
```

(a) [4] Please fill in the array parameter definition in line 02.
(b) [4] Please fill in the loop execution condition line 05.
(c) [4] Please explain the purpose of expression (i%2*2-1) in line 06.
(d) [4] Please complete the blank in line 06 for conversion of a character to its numerical value.
(e) [4] Please complete the return statement in line 7 to detect if the decimal string is a multiple of 11.
(f) [4] Please explain the method used by this program to determine if a very large number is a multiple of 11.
(g) [4] Please fill in the blank in line 12 the conversion command of scanf. Please specify the length such that the conversion would not use memory space more that it is allowed to use.

3. The following program segment is to calculate the length of the longest closed sequence of 0's in the binary representation of an integer n. For example, the binary representation for n=529 is 1000010001. There are two sequence of 0 enclosed by 1, the length of each are 4 and 3. Therefore the program outputs 4 as the result. Note for n=20, the binary representation is 10100. There is only one closed 0 sequence with length 1. For n=15, there is no closed 0 sequence in its binary representation 1111. For n=32, there is no closed 0 sequence in its binary representation 100000.

```
01 while (n%2==0&&n>0) n/=2;
02 maxLen = 0;
03 while (n>0) {
04      for (n/=2,len=0; n%2==0&&n>0; n/=2) len++;
05      if (_____) _____;
06 }
07 printf("%d\n", maxLen);
```

(a) [4] Please use n=20 as example to explain the condition n%2==0 of the while loop in line 01.
(b) [4] problem (a) continued, why do we need the condition n>0 for the while loop in line 01?
(c) [4] problem (b) continued, please explain the effect of n/=2; in line 01?
(d) [4] A for loop is used to calculate the length len of a closed 0 sequence in line 04. Please continue the previous 3 subproblems and use n=20 to explain the meaning of n/=2 in the loop initialization.
(e) [4] Please finish the if statement to calculate the length of the longest closed 0 sequence maxLen

4. Please write a program to read input shown in the figure on the right hand side. Each test cases has two lines, each line contains an integer sequence. For example the sequence 5 1 2 5 9 17 in the first line. The first number 5 is the length of the sequence, followed by the 5 integers. For each test case, your program needs to merge and print out the two sequences in ascending order.

| 範例輸入 |
| --- |
| 5 1 2 5 9 17 |
| 4 8 13 23 25 |
| 4 7 8 9 10 |
| 6 1 2 3 8 8 |

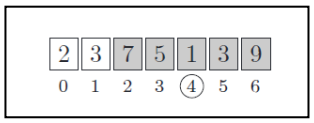
| 範例輸出 |
| --- |
| 1 2 5 8 9 13 17 23 25 |
| 1 2 3 7 8 8 8 9 10 15 |

(a) [4] If the length of each sequence is limited to 100, please define suitable arrays to hold the sequences from the input stream.

(b) [4] Please write the loop to read both sequences from the input stream.

(c) [8] Please write a loop and selection statement to merge and print two sequences in ascending order.

5. In the right hand side figure, each number shown in the cell denotes the number of mushrooms along a forest trail. The mushroom collector can move one step for a position and collect all the mushrooms on that spot. Assume the collector starts from position k=4. Please write a program to calculate the maximum amount of mushrooms he can collect if he is only allowed to a maximum of m=6 steps. Because each time the mushroom collector turn around, he would waste several steps to those empty cells, you might find out that an efficient mushroom collector would turn around at most once. Please following the instructions from (a) to (f) to answer, explain, and finish the following program:




| 範例輸入 | 範例輸出 |
|---|---|
| 4 6 7<br>2 3 7 5 1 3 9 | 25 |

```
01 #include <stdio.h>
02 int main()
03 {
04      int k, m, n, i, x, psum[1001]={0}, max, t, left, right;
05      while (3==scanf("%d%d%d", &k, &m, &n))
06      {
07          for (i=1; i<=n; i++)
08          {
09              scanf("%d", &x);
10              _____;
11          }
12          for (max=0,i=k-m<0?0:k-m; i<k; i++)
13          {
14              right = k;
15              if (m-(k-i)+i > right) right = m-(k-i)+i;
16              if (right>=n) right = n-1;
17              if ((t=_____)>max) max = t;
18          }
19          for (i=_____; i>k; i--)
20          {
21              left = k;
22              if (_____ < left) left = _____;
23              if (left<0) left = 0;
24              if ((t=_____)>max) max = t;
25          }
26          printf("%d\n", max);
27      }
28      return 0;
29 }
```

(a) [4] The mushroom collector starts at cell 4, leftward to cell 2 and turns back to cell 6 such that he passed cell 3,2,3,4,5,6 with a total of 6 steps. The amount of collected mushrooms is the sum of cell 2 to cell 6. It is not necessary to add the contents of array every time we try to evaluate a possible collecting strategy. In the above program, we form a prefix sum array *psum* of the amount of mushrooms right after reading them from the input stream in line 10. For this particular example, the amount of mushrooms are 2 3 7 5 1 3 9, the prefix sum array *psum* is defined as $\text{psum}[i]=\sum_{j=0}^{i}\text{mushrooms}[j]$, with contents 2 5 12 17 18 21 30. In this way, the total of mushrooms in cells 2~6 would be calculate by psum[6]-psum[2-1] = 30-5=25. Please fill in the blank in line 10 to setup the content of array *psum*.

(b) [4] Line 12~18 calculate the maximum amount of collected mushrooms starting from the k-th cell leftward to the i-th cell and turn around to cell *right*. Please explain the meaning of line 14, 15, and 16.

(c) [4] Please fill in the calculation of the amount of collected mushrooms in line 17.

(d) [4] Line 19~25 calculate the maximum amount of collected mushrooms starting from the k-th cell rightward to the i-th cell and turn around to cell *left*. Please finish the calculation for the starting value of i in line 19.

(e) [4] Please fill in the blank for calculating the value of *left* in line 22.

(f) [4] Please fill in the calculation for the maximum amount of collected mushrooms in line 24.