THE HONG KONG POLYTECHNIC UNIVERSITY

DEPARTMENT OF COMPUTING

EXAMINATION

Course : Broad Discipline of COMP-61431, Minor Programme

Subject : COMP1011 Programming Fundamentals

Group : 2011, 271

Session : 2018 / 2019 Semester II

Date : 27 April 2019 Time : 15:15 - 18:15

Time Allowed: 3 Hours Subject Lecturer: Dr ZHENG Yuanqing

This question paper has 9 pages (cover included).

Instructions to Candidates:

This is an Open-Book examination.
Please answer ALL questions.

Do not turn this page until you are told to do so!

Question 1. [5 Marks] Given the following C program (to be completed), answer the following questions.

```
1  #include <stdio.h>
2  int main() {
3    int op = 2;
4    switch (op) {
5    case 1: printf("Hello ");
6        break; // break will be deleted in question (b)
7    case 2: printf("Good ");
8        break; // break will be deleted in question (b)
9    case 3: printf("Luck ");
10       break; // break will be deleted in question (b)
11   case 4: printf("In ");
12       break; // break will be deleted in question (b)
13   case 5: printf("The ");
14       break; // break will be deleted in question (b)
15   default:
16       printf("Exam ");
17   }
18   return 0;
19 }
```

(a) [2 Marks] What is the output of the above C program?

(b) [3 Marks] Suppose we delete all break statements in the above C program (i.e., break in Line 6, Line 8, Line 10, Line 12, and Line 14). What is the output of the above C program?

Question 2. [6 Marks] What is the output of the following C program?

```
20 int main() {
21   int a;
22   struct node_struct {
23       char name[100];
24       char title[100];
25       float value;
26   };
27   union node_union {
28       char name[100];
29       char title[100];
30       float value;
31   };
32   printf("%d\n", sizeof(a));
33   printf("%d\n", sizeof(struct node_struct));
34   printf("%d\n", sizeof(union node_union));
35   return 0;
36 }
```

Question 3. [6 Marks] What is the output of the following C program?

```
1  #include <stdio.h>
2  void functionX(int a, int *b) {
3    a = 7;
4    *b = a;
5    b = &a;
6    *b = 9;
7    printf("%d, %d\n", a, *b);
8  }
9  int main() {
10   int m = 5, n = 10;
11   functionX(m, &n);
12   printf("%d, %d\n", m, n);
13   return 0;
14 }
```

Question 4. [8 Marks] Given the following C program (to be completed), answer the following questions.

```
1  #include <stdio.h>
2  int main() {
3    char *str_comp = "1011";
4    char *str_1011 = "COMP";
5
6    //ToDo: Write code according to requirements
7
8    printf("%s%s", str_comp, str_1011);
9    system("pause");
10   return 0;
11 }
```

(a) [3 Marks] What is the output of the above C program?

(b) [5 Marks] We find that in the above C program, str_comp points to "1011" and str_1011 points to "COMP". In order to correctly print out "COMP1011", we want to develop a swap function to swap the two strings. **1)** Please develop a swap function; **2)** Add a line in Line 6, so that the two strings (i.e., str_comp, str_1011) can be swapped.

Question 5. [15 Marks] Given the following C program, answer the following questions.

```
1  #include <stdio.h>
2  #define SIZE_OF_DATA 10
3  #define SIZE_OF_COUNT 100
4
5  void functionX(int data[]) {
6    int count[SIZE_OF_COUNT + 1];
7    for (int i = 0; i <= SIZE_OF_COUNT; i++) {
8        count[i] = 0;
9    }
10   for (int i = 0; i < SIZE_OF_DATA; i++) {
11       count[data[i]]++;
12   }
13   for (int i = 0; i <= SIZE_OF_COUNT; i++) {
14       while (count[i]) {
15           printf("%d ", i);
16           count[i]--;
17       }
18   }
19 }
20 int main() {
21   int data[SIZE_OF_DATA] = {100, 12, 23, 4, 35, 66, 87, 68, 99, 66};
22   functionX(data);
23   return 0;
24 }
```

(a) [5 Marks] What is the output of the above C program?

(b) [5 Marks] Assume that the integer array (i.e., int data[SIZE_OF_DATA]) is used to store integers between 0 and 100, what task can be achieved by the function in Line 5 – Line 19:

void functionX(int data[])

(c) [5 Marks] Please give comments to the three **for** loops (Line 7-9, Line 10-12, and Line 13-18) in **void functionX(int data[]).**

Question 6. [16 Marks] A sequence ($S_0 S_1 \ldots\ldots S_n$) is formed such that each number is the sum of the **three preceding numbers**, starting from 0, 1, 1. That is

$$S_0 = 0,\ S_1 = 1,\ S_2 = 1 \text{ and } S_n = S_{n-1} + S_{n-2} + S_{n-3} \text{ for } n > 3.$$

The beginning of the sequence is thus: 0, 1, 1, 2, 4, 7, 13, 24, 44, 81, 149, ……

For example, the fifth number is 4. That is because the three preceding numbers before the fifth number are 1, 1, and 2. Thus, we have fifth number = 1 + 1 + 2.

We want to print the first 20 numbers in the sequence by calling the function **int functionX(int n)** in the following C program. Let's suppose 0 is the first number in the sequence.

```
1  #include <stdio.h>
2  int functionX(int n) {
3    // ToDo: Write code according to requirements
4  }
5
6  int main() {
7    for (int i = 0; i < 20; i++) {
8        printf("%d, ", functionX(i));
9    }
10   return 0;
11 }
```

(a) [8 Marks] Design and implement a **recursive** version of **int functionX(int n)**.

(b) [8 Marks] Design and implement an **iterative** version of **int functionX(int n)**.

Question 7. [10 Marks] Given the following C program, what are the output of the program?

```
1  #include <stdio.h>
2  int main() {
3    char str[] = "012345";
4    char *ptr = str;
5    *ptr++ = '1';
6    printf("%s\n", str); // (a)
7    printf("%s\n", ptr); // (b)
8    *(++ptr) = '9';
9    printf("%s\n", ptr); // (c)
10   printf("%s\n", ptr--);//(d)
11   *(str + 2) = '\0';
12   printf("%s\n", --ptr);//(e)
13   return 0;
14 }
```

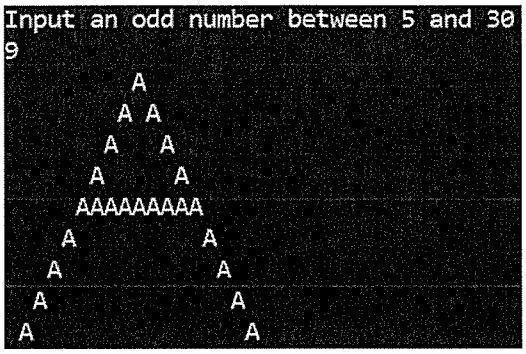
Question 8. [16 Marks] Given the following C program (to be completed), answer the following questions.

```
1  #include <stdio.h>
2  struct list_element {
3    int value;
4    struct list_element *next;
5  };
6  typedef struct list_element node;
7  int main() {
8    node * curr = NULL, *head = NULL;
9    int i;
10   for (i = 1; i <= 10; i++) {
11       // ToDo: Write code according to requirements
12   }
13   curr = head;
14   while (curr) {
15       printf("%d ", curr->value);
16       curr = curr->next;
17   }
18   return 0;
19 }
```

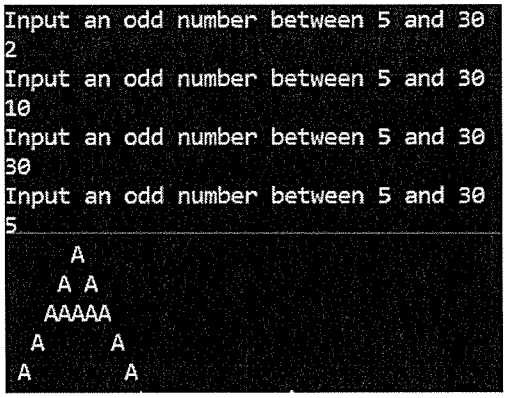
(a) [8 Marks] Modify the program by adding a few lines of code in Line 11, so that the output is "1 2 3 4 5 6 7 8 9 10".

(b) [8 Marks] Modify the program by adding a few lines of code in Line 11, so that the output is "10 9 8 7 6 5 4 3 2 1".

Question 9. [18 Marks] Write a C program to print "A" in the following shape. The function should take *n* from user's input. The user's input should be an odd integer between 5 and 30. The following picture shows an example when user's input is 9.



1) The program should output a message of "Input an odd number between 5 and 30" and wait for user's input.
2) If the user's input is not an odd integer between 5 and 30, the program should output "Input an odd number between 5 and 30" and wait for a new input from the user, until the user's input is correct as shown in the following screen shot.
3) Since the code is hand-written without the help of IDE, minor mistakes that can be easily fixed are allowed. Thus, please add comments to your code if necessary.



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