RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. in Information Technology
First Year - Semester I Examination – July / August 2023

ICT 1402 – PRINCIPLES OF PROGRAM DESIGN AND PROGRAMMING

Time: Three (03) hou

- This paper has four (04) questions in eighteen (18) pages.
- Answer **ALL** questions.
- All questions carry equal marks.
- Write your answers in English using the space provided in this question paper.
- Do not tear off any part of this question paper.
- Note that questions appear on both sides of the paper.
- If a page is not printed, please inform the supervisor immediately.

Examination Index No:	

To be completed by the examiners:

	Question numbers				**Total Marks**
Questions	**1**	**2**	**3**	**4**	
Marks					

1. a) What is the main function of a Compiler? (02 marks)

b) Find the correct C identifiers from the list below and fill in the given table. (03 marks)

Identifier	Valid or Invalid	Reason for Invalidation
0x16		
rate$		
_mul65		
Case		
j		
5th_module		
structure-		

c) Based on the rules of C operator precedence and associativity, evaluate the following expressions. Show all steps. (06 marks)

i. 3/2.0*5-4

ii. 1 && 1 || 0

iii. (2+4/4) && (3+4/4-3)

iv. 1 || 1 +3-4 && 1

v. 5%2*5/5+100

vi. (100%2==0)?100/2:100*5

d) What is the output of the following C program? Write your answer clearly in the grid provided. Also, write only one character in one cell. (03 marks)

```
#include <stdio.h>
int main(){
    float value = 12.3456f;
    int number = 12;
    printf ("%.2f\n",value);
    printf ("%10.2f\n",value);
    printf ("%4i\n",number);
    printf ("%04d\n",number);
    printf ("%-20s\n","MY VALUE");
    printf ("%10s\n","MY NAME");
    return 0;
}
```


Write the answers to Question 1 Parts (e) and (f) using the following C program. Assume the source file is already built and saved as cla.exe.

```
#include <stdio.h>
int main( int argc, char *argv[] ){
    printf("%s %s %s %s %s\n",
         argv[7], argv[3], argv[5],argv[2], argv[8]);
    return 0;
}
```

e) Write the output of the program if it is run using the following command.

```
>cla.exe The brown cat sits on the small mat.
```
(01 mark)

f) How to change the above C program to generate the following output.

```
The brown small cat
The small brown cat mat.
```

(04 marks)

g) Write the output of the following C program. (06 marks)

```
#include <stdio.h>
int main (){
    int x, y;
    for ( x = 1; x<7; x++){
        for ( y = 1; y<10; y++){
            if (y == x)
                break;
            printf ("%2i ", x );
        }
        printf ("\n");

    return 0;
}
```

2. Following list represents the data usage of the three faculties of a university.

Faculty	Wifi (GB)	Mobile (GB)	ADSL (GB)
Computing	500	1000	300
Science	15	1800	200
Engineering	200	400	700

Answer Questions 2 Parts (a) to (c) using the table above. Assume usage data is stored in the following array called units.

```
#include <stdio.h>
int units [3][3] = {{500, 1000, 300},
                    {10, 1800, 200},
                    {200, 400, 700}};
int main()
{
    return 0;
}
```

a) Write the C source code to find the total unit consumed by the university. (03 marks)

b) Write the C source code to find the faculty with the highest WiFi usage. (04 marks)

c) Write the C source code to find the average data usage of the Faculty of Science. Note that the final answer must be shown using two decimal places. (04 marks)

Question 2 parts (d) and (e) are based on the MS Airways case study.

MS Airways – Case Study

MS Airways has implemented a frequent flier monitoring system to offer attractive packages to their passengers. Package details are as follows:

Frequent Flier Category	***Package***
MS Economy	15% discount for any air ticket
MS Plus	20% discount for any air ticket with 10USD meal package
MS Master	25% discount for any air ticket with 20USD meal package

d) Write a task list to display the discounted ticket price and other benefits according to the frequent flier category. (10 marks)

e) Construct a flowchart for the task list wrote in the Question 2 Part (d). (04 marks)

3. a) Justify the following statement regarding the C functions. C functions allow the use of a divide-and-conquer strategy for program development. (02 marks)

b) Fill in the following table based on the comparison between pass-by-value and pass-by-reference parameter passing methods. (04 marks)

Criteria	Pass-by-value	Pass-by-reference
Mechanism of Parameter Passing		
Memory Requirements		
Time Requirements		
Changing the contents of actual parameters		

Write the answer for Question 3 Parts (c) to (e) using the following C program.

```
1.   #include <stdio.h>
2.   int sum(int,int);
3.   int sum(int a, int b) {
4.      printf ("%d\n",  a);
5.      printf ("%d\n",  b);
6.      return a + b;
7.   }
8.   int a = 20;
9.   int main () {
10.    int a = 10, b = 20, c = 30;
11.    printf ("%d\n",  a);
12.    c = sum( a, b);
13.    printf ("%d\n",  c);
14.    printf ("%d\n%d\n",  c+a, c+a/b);
15.    return 0;
16.  }
```

c) State the meaning of source code lines 2, 3, and 12. (03 marks)

Line 2:

Line 3:

Line 12:

d) Specify the scope of the variable 'a' in lines 3, 8, and 10. (03 marks)

Line 3:

Line 8:

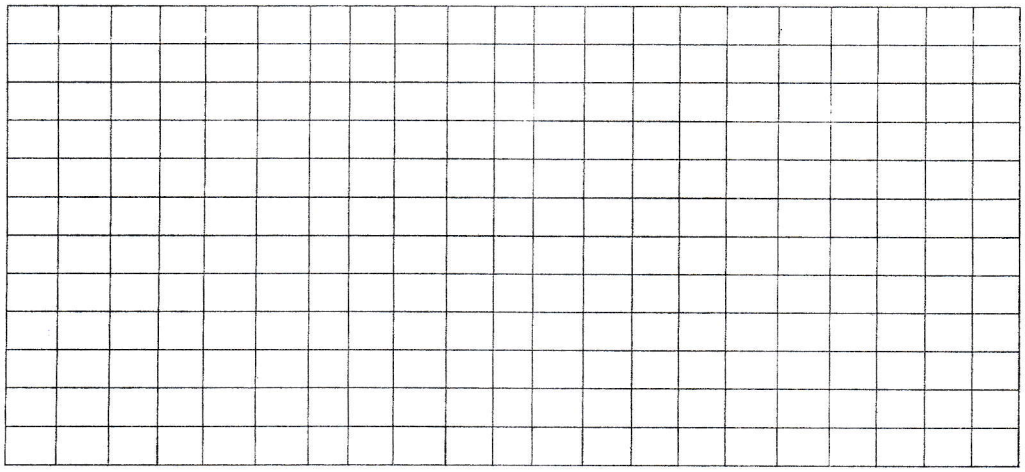
Line 10:

e) Write the output of the program. (03 marks)

Write the answers for Question 3 Parts (f) to (h) using the following C program.

```
1.   #include <stdio.h>
2.   int ratingCounters[11];
3.   int response[] = {3,1,3,5,6,3,5,1,7,8};
4.   void doPrint (){
5.       int i;
6.       printf ("RATING #OF RESPONSES\n");
7.       for ( i = 1; i <= 10; ++i )
8.           printf ("%4i%14i\n", i, ratingCounters[i]);
9.   }
10.  void doRating (){
11.      int i;
12.      for ( i = 1; i <= 10; ++i ){
13.          ratingCounters[i] = 0;
14.      }
15.      for ( i = 0; i < 10; ++i ) {
16.          if ( response[i] < 1 || response[i] > 10 )
17.              printf ("Bad response: %i\n", response);
18.          else
19.              ++ratingCounters[response[i]];
20.      }
21.      doPrint();
22.  }
23.  int main (){
24.      doRating( ratingCounters, response);
25.      return 0;
26.  }
```

What will be the output of the given C program? Use the grid to write the answer. Also, write only one letter in a cell. (05 marks)



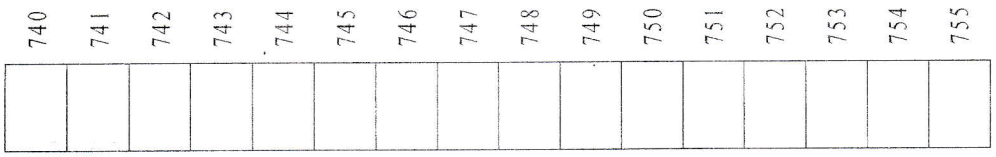
g) Modify the given C program to assign values to the response array using keyboard input and a **for** loop. (03 marks)

h) Specify how the condition in line 16 is satisfied. (02 marks)

Write the answers for Question 4 Parts (a) and (b) using the following C program.

```
1.  #include <stdio.h>
2.  int main (){
3.      int var = 35, i2,*ptr,*ptr2;
4.      ptr = &var;
5.      printf("%i - %i\n", var, &var);
6.      printf("%i\n", *ptr);
7.      printf("%i\n", ptr);
8.      ptr2=ptr;
9.      printf("%i\n",*ptr2);
10.     printf("%i - %i \n", &ptr, &ptr2);
11.     if (&ptr < &ptr2)
12.         i2 = *ptr / 2 + 10+(++*ptr);
13.     else
14.         i2 = *ptr / 2 + 10+(*ptr++);
15.     printf ("%i\n", i2);
16.     return 0;
17. }
```

) Fill the memory block diagram given below to show how the four variables var, i2, *ptr, *ptr2 are declared and initialized after running the C program. Assume the memory addresses of var, i2, *ptr, *ptr2 are 752, 748, 744, and 740, respectively. (04 marks)



) What will be the output of the given C program? (04 marks)

c) Rewrite the following C program to get the same output by changing **`int p=i`** to **`int p=&i`**. (04 marks)

Output of the following program is:

```
i = 50
i = 150
```

Hint: Use pointers appropriately.

```
#include <stdio.h>
int test (int);
int test (int int_pointer){
    int_pointer += 100;
    return int_pointer;
}
int main (void){
    Int i = 50;
    int p =i;
    printf ("i = %i\n", i);
    i= test (p);
    printf ("i = %i\n", i);
    return 0;
}
```

f) Declare a C structure named boarding_pass by analyzing the sample boarding pass shown in the figure. (05 marks)

g) Create an array named passenger_details to hold 250 boarding pass details. (01 mark)

h) Write a C statement to store the details of passenger James Bond in the passenger_details array declared in Question 4 (g). (03 marks)

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