UNIVERSITY OF SOUTHAMPTON FEEG6002C1

SEMESTER 1 EXAMINATIONS 2016-17

Advanced Computational Methods 1

DURATION 120 MINS

This paper contains 8 **Questions. Answer All Questions.**

This is a Computer-Based Exam.

All answers must be saved in the default folder "My Documents".

For all questions, template files have been provided for your use. These files can be found in My Documents.

A total of 100 marks are available for this paper. Marks available for answering parts of the questions are shown in brackets thus [ ].

A foreign language direct 'Word to Word' translation dictionary (paper version ONLY) is permitted, provided it contains no notes, additions or annotations.

1. a). What is a version control system?.

b). Explain three reasons for using a version control system.

c). Write at least 5 basic Git commands and describe their functionality.

Answer this question using the notepad editor to open the file `q1.txt`. You must save the file upon completion.

[10 marks]

2. Fill in the blanks in each of the following.

a). Every C program begins execution at the function _____.
b). A program module in C is called a _____.
c). The _____ statement in a called function is used to pass the value of an expression back to the calling function.
d). The _____ standard library function displays information on the screen.
e). Keyword _____ is used in a function header to indicate that a function does not return a value or to indicate that a function contains no parameters.
f). The _____ standard library function is used to obtain data from the keyboard.
g). The conversion specifier _____ is used in a `scanf` format control string to indicate that an integer will be input and in a `printf` format control string to indicate that an integer will be output.
h). The _____ statement is used to make decisions.
i). The _____ selection structure is used to execute one action when a condition is true and another action when that condition is false.
j). The _____ repetition structure specifies that a statement or a group of statements is to be executed repeatedly while some condition remains true.

Answer this question using the notepad editor to open the file `q2.txt`. You must save the file upon completion.

[10 marks]

3. Find the error on each of the following code segments and explain how to correct it.

a).

```
x = 1;
while (x <= 10);
x++;
}
```

b).

```
for (y = .1; y != 1.0; y + = .1)
printf("%f\n", y);
```

c). The following code should print the values 1 to 10.

```
n=1;
while (n < 10)
printf ("%d" , n++);
```

d).

```
while (c <= 5) {
product *=c;
++c;
```

e).

```
void print_door_status(int s) {
if (s == 1)
    printf("open");
else;
    print("closed");
}
```

Answer this question using the notepad editor to open the file `q3.txt`. You must save the file upon completion.

[10 marks]

TURN OVER

4. a). Open and extend the file `q4a.c` by adding a function '`product`' that accepts three arguments of type integer, and returns the product of its arguments as a value of type integer. You may extend the provided `main()` function to complete the solution:

```
#include <stdio.h>

int main(void) {
    printf("Result = %d\n", product(1, 2, 3));
    return 0;
}
```

Answer this question using the Quincy editor to open and extend the file `q4a.c`. You must save the file upon completion.

b). Open and extend the file `q4b.c` by adding a function '`sum_integers`' to calculate the sum of the integers from 1 to 10 and return this number as a value of type integer. You may extend the provided `main()` function to complete the solution:

```
#include <stdio.h>

int main(void) {
    printf("Sum = %d\n", sum_integers());
    return 0;
}
```

Answer this question using the Quincy editor to open and extend the file `q4b.c`. You must save the file upon completion.

[20 marks]

5. A student's letter grade is calculated according to the following schedule.

Numerical Grade	Letter Grade
greater than or equal to 90	A
less than 90 but greater than or equal to 80	B
less than 80 but greater than or equal to 70	C
less than 70 but greater than or equal to 60	D
less than 60	F

Open and extend the file `q5.c` by adding a function '`grade`' that accepts a student's numerical grade as a double-precision floating point value, converts the numerical grade into an equivalent letter grade, and displays the letter grade to the standard output. You may extend the provided `main()` function to complete the solution:

```
#include <stdio.h>
int main(void) {
    grade(54.);
    grade(100.);
    return 0;
}
```

Answer this question using the Quincy editor to open and extend the file `q5.c`. You must save the file upon completion.

[10 marks]

TURN OVER

6. Open and extend the file `q6.c` by adding a function `'compute_mean'` so that the program provided compiles and computes the average of the numbers stored in `data1` and `data2`. The `'compute_mean'` function should accept an array of values of type `double` as the first argument and the length of that array as the second argument. It should return the arithmetic mean. You may extend the provided `main()` function to complete the solution:

```
#include<stdio.h>

int main(void)
{
    double data1[6] = {23.2, 31.5, 16.9, 27.5, 25.4, 28.6};
    double data2[6] = {10.0, 20.0};
    printf("The mean is %f.\n", compute_mean(data1, 6));
    printf("The mean is %f.\n", compute_mean(data2, 2));
    return 0;
}
```

Answer this question using the Quincy editor to open and extend the file `q6.c`. You must save the file upon completion.

[10 marks]

7. Write two functions `'zero_array'` and `'delete_array'` so that the following code (provided in `q7.c`) becomes operational and will print `"0 0 0 0 0 "` to the screen.

The function `'zero_array(int n)'` should dynamically allocate memory for an array of integers of type '`int`' and array length '`n`'. The function should return a pointer to that allocate memory. The function `'delete_array'` should take a pointer to that memory, and de-allocate the memory. You may extend the provided `main()` function to complete the solution:

```
#include <stdio.h>
#include <stdlib.h>

void print(int *a, int n) {
    int i = 0;
    for (i=0; i<n; i++) {
        printf("%d ", a[i]);
    }
}


int main() {
    int n = 5;
    int* a = zero_array(n);
    print(a, n);
    delete_array(a);
    return 0;
}
```

Answer this question using the Quincy editor to open and extend the file `q7.c`. You must save the file upon completion.

[15 marks]

TURN OVER

8. Open and extend the file `q8.c` by writing a function `'center'` that accepts a string '`s`' as the first argument, and an integer number '`n`' (of type `'int'`) as the second. The function should return a new string that centers the string `'s'`, surrounding it by '`-`' to fill '`n`' characters overall.

For example, given the string `'cat'` and the total number `'n=5'`, the string the function computes should be `'-cat-'`.

For `'cat'` and `'n=6'`, both `'--cat-'` and `'-cat--'` are acceptable outputs. For `n=7`, we expect `'--cat--'`.

You may extend the following template to complete the solution:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

int main(void) {
    char s[] = "cat";
    char *ret;
    ret = center(s,5);
    printf("%s\n", ret);
    free(ret);
    ret = center(s, 6);
    printf("%s\n", ret);
    free(ret);
    ret = center(s, 7);
    printf("%s\n", ret);
    free(center);

    return 0;
}
```

Answer this question using the Quincy editor to open and extend the file `q8.c`. You must save the file upon completion.

[15 marks]

END OF PAPER

