

Université d'Ottawa  
Faculté de génie

École d'ingénierie et de  
technologie de l'information



uOttawa

L'Université canadienne  
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Faculty of Engineering

School of Information  
Technology and Engineering

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**GNG 1106**

**Examen de mi-session / Midterm Examination**

**March 5<sup>th</sup>, 2011**

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**Time allowed: 90 minutes**

**Closed book examination**

**Non-programmable calculators are allowed**

**Attempt all questions**

**Questions carry the weights indicated**

**The total number of points for the examination is 100**

**Answer the questions in the spaces provided**

**Use both sides of these sheets if necessary**

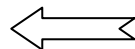
**Les réponses en français sont acceptées.**

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**Name:** \_\_\_\_\_

**Student Number:** \_\_\_\_\_

Part 1:	30
Part 2:	35
Part 3:	35
Total:	100



Do not write in this box!

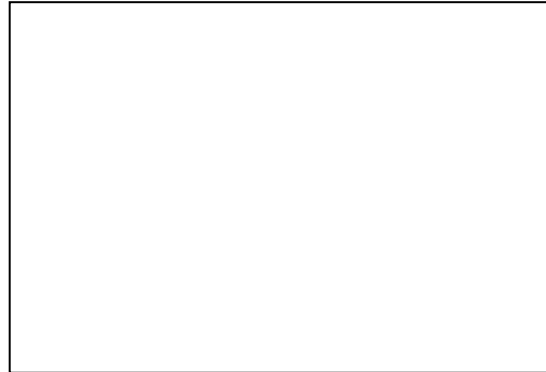
## Part 1 – Tracing (30 points)

A) (4 points)

```
int x = 130;

if(x >= 0 && x <= 100)
    printf("Valid grade");
else
{
    if (x < 0)
        printf("Under range!!");
    else
        printf("Over range!!");
}
```

Output Screen



B) (6 points)

```
i = 1;

while (i < 10)
{
    if (i%3 == 0)
        printf("%d \n", i);
    else
        printf("%d\t", i);
    i++;
}
```

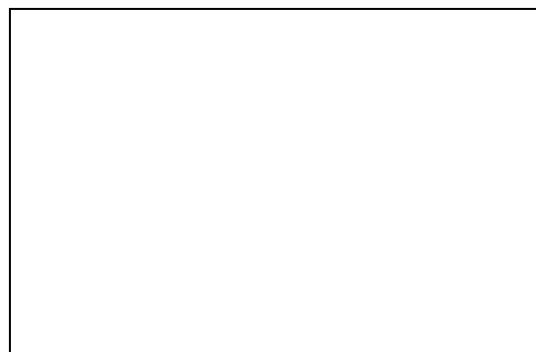
Output Screen



C) (8 points)

```
for (i = 4; i > 0; i--)
{
    for (j = 0; j < i; j++)
        printf("*");
    printf("%d\n", i+j);
}
```

Output Screen



D) (12 points)

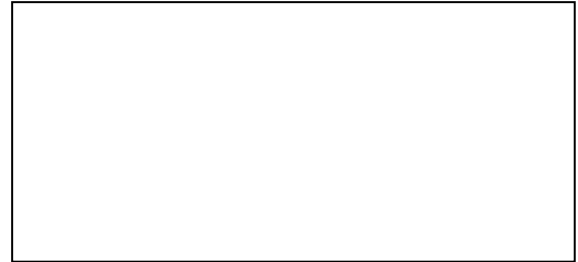
Assume the following declaration for the array g:

```
int i, j, g[3][3] = {{0,0,0},{1,1,1},{2,2,2}};
```

Write down the screen output generated by each of the following C codes:

```
sum = 0;
for (i = 0; i <= 2; i++)
{
    for (j = 0; j <= 2; j++)
        sum = sum + g[i][j];
}
printf ("The value is: %d", sum);
```

Output Screen



```
sum = 1;
for (i = 1; i <= 2; i++)
{
    for (j = 0; j <= 1; j++)
        sum = sum * g[i][j];
}
printf ("The value is: %d", sum);
```

Output Screen



```
sum = 0;
for ( i = 0; i <= 2; i++)
    sum = sum + g[i][1];

printf ("The value is: %d", sum);
```

Output Screen



## Part 2 - Debugging (35 points)

A) (17 points)

This program is supposed to compute the product of the entries for a one dimensional array. Find six errors (syntax and/or Logical) in the program. Find the program line numbers where these errors occur and explain them.

```
1.     #include <stdio.h>
2.     #define N 6
3.
4.     void Function (float array[]);
5.
6.     int mian()
7.     {
8.         int i;
9.         float array[N];
10.        float Product;
11.
12.        for (i=0; i<=N; i++)
13.            scanf("%f", &array(i));
14.
15.        Product = Function(array);
16.
17.        printf("%f\n", Product);
18.
19.        Return (0);
20.    }
21.
22.    void Function (float tab[])
23.    {
24.        float product=0;
25.
26.        for (i=0; i<N; i++)
27.            product= product*tab[i];
28.
29.        return(product);
30.    }
```

a) Line number:

---

---

b) Line number:

---

---

c) Line number:

---

---

d) Line number:

---

---

e) Line number:

---

---

f) Line number:

---

---

B) (9 points)

This code is supposed to exit when the user inputs 0 or repeat adding two numbers if the user inputs 1. Find three logical and/or syntax errors in this program.

```
1.  int choice, num1, num2:
2.
3.  do
4.  {
5.      printf("Enter a number: ");
6.      scanf("%d", &num1);
7.      printf("Enter another number: ");
8.      scanf("%d", &num2);
9.      printf("Their sum is %d\n" , (num1+num2));
10.     printf("Enter 1 to repeat, 0 to exit");
11.     scanf("%d", &choice)
12.     } while (choice == 0)
```

a) Line number:

---

---

b) Line number:

---

---

c) Line number:

---

---

C) (9 points)

There are three errors in this program.

```
1.   int a = - 75;
2.
3.   if (a ≥ 0)
4.       if (a > 1000)
5.           a = 0;
6.       else
7.           if (a < 500);
8.           a = a + 2;
9.       else
10.          a = a*10;
      else
11.    a = a + 3;
12.    printf('The output is %f', a);
```

a) Numéro de ligne:/Line number:

---

---

b) Numéro de ligne:/Line number:

---

---

c) Ligne numéro:/Line number:

---

---

### Part 3 – Problem Solving: Computing Bank Investments (35 points)

a) 2 points; b) 3 points; c) 6 points; d) 12 points; e) 12 points

Your project is to design a software tool to compute what amount  $A$  will be generated when an amount  $P$  is invested (the principal) and an annual interest rate,  $i$ , for all the years from 1 to  $n$ . The software provides two options to the user, a first that simply outputs the amount  $A$  along with the values  $P$ ,  $i$ , and  $n$  provided by the user and the second where a table is generated that shows how the amount  $A$  progresses each year (from year 1 to year  $n$ ) also with the values  $P$ ,  $i$ , and  $n$  provided by the user.

The following formula relates  $A$ ,  $P$ ,  $i$ , and  $n$ :  $A = P(1+i)^n$

Here is a description of the software subprograms to be used in the software:

- `displayMenu()`: a subprogram that displays the main menu to the user and return only a valid choice to the main subprogram (valid options are 1, 2, and -1).
- `computeAmount(A, P, i, n)`: a subprogram that computes all the amounts at the years 1 to  $n$  and stores them in the array  $A$ . The subprogram does not return any value as the amount values will be stored in the array.
- `printTable(A, P, i, n)`: a subprogram that prints the values  $P$ ,  $i$  and  $n$ . Then it prints a table of the years 1 to  $n$  and the corresponding amount earned (from the array  $A$ ). The sub-program should be void!
- `main()`: the main subprogram first calls the `displayMenu()` subprogram and according to the returned value calls either the `computeAmount(P, i, n)` or the `printTable(P, i, n)` subprograms. The main keeps looping back until the user inputs -1 to exit!

a) **Step 1 – Statement of the problem:** provide a clear description of the problem to be solved.

**Answer (2 points):**

b) **Step 2b – Input and Output Description:** Give a diagram that shows all inputs and outputs of the software tool.

**Answer (3 points):**

- c) **Step 3a** – *Test Cases*: Give three test cases for the software tool covering the followings cases: (1) when the user inputs invalid option, (2) when the user picks option 1 (computing and printing A), and (3) when the user picks option 2 (printing a table of amounts (A) over the years).

**Answer (6 points):**

d) **Step 3b** – *Algorithm design*:

Write the pseudocode for the `displayMenu()` and the `computeAmount(A, P, i, n)` subprograms (C code is not accepted for this part!):

**Answer (5 points + 7 points):**

*displayMenu()*

*computeAmount(A, P, i, n)*

e) Step 4 – Implementation:

Translate the following pseudocode to C code.

*main () (8 points)*

*Declare A, p, n, i and choice*

*Repeat*

*Print “Enter values for p, n, and i”*

*Read values into p, n, and i*

*computeAmount(A, P, i, n)*

*Assign displayMenu() to choice*

*If choice is equal to 1*

*Print “P = ”, p, “i = ”, i, “n = ”, n*

*Print “The final amount A = ”, A[n-1]*

*Else if choice is equal to 2*

*printTable(A, P, i, n)*

*else*

*print “program terminating ...”*

*while choice is not equal to -1*

C Code

```
int main()
{

return (0);
}
```

*printTable (A, p, i, n)* (4 points)

*Declare ctr*

*Assign 0 to ctr*

*Print "P =", p, "i =", i, "n =", n*

*Print "Year" tab "Amount"*

*Repeat while ctr is less than n*

*print ctr+1, A[ctr], newline*

*Increment ctr*

C Code

```
void printTable(float A[], float P, int i, int n)
{

}
}
```

**Extra page (you can detach this page and use it as scratch)**