

MEMORIAL UNIVERSITY OF NEWFOUNDLAND  
DEPARTMENT OF MATHEMATICS AND STATISTICS

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AMAT 2120

MIDTERM TEST

October 26, 2005

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NAME	ID
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Contents:

- [25%]      1. (a-e) Multiple choice
- [30%]      2. Write a program
- [30%]      3-4. Trace code
- [15%]      5. Find errors

1. Check all correct answers.

a. Suppose `Test1` and `Test2` are two subdirectories of the same parent directory. There is file `myprog.c` in the directory `Test1`. Your current working directory is `Test2` and you want to save a copy of the existing file under the name `prog2.c`. Which command will do it?

- `cd ../Test1/myprog.c prog2.c`
- `cp ../Test1/myprog.c prog2.c`
- `ls Test1/*.c Test2/prog2.c`
- `mv ../Test1/myprog.c ./prog2.c`
- `pwd ./prog2.c ../Test1/myprog.c`

b. If variables `int n` and `double x` are declared in the program, then the assignment `x=n` is

- safe and sound
- will pass compilation but may lead to a mathematical error due to roundoff effect
- will cause no problems for the program, but isn't best in terms of style; better use the explicit cast: `x=(double)n;`

c. What is, technically, the word `main` at the beginning of every C program?

- Simply a C keyword meaning that the program begins here.
- A reserved name of function recognized by the operating system, which initiates execution of this function.
- A preprocessor directive; preprocessor expands this word into a standard library file.
- A conventional commonly adopted name of a C program; however, the programmer is free to use a different name.

d. Which sentence best describes the following tiny program?

```
int main()
{
    while(5){ return(0);}
}
```

- The program will stop instantly without printing anything.
- The loop condition is always true and the program will never stop.
- The program will return value 0 five times.
- return(0)** is misplaced; however the program will pass compilation.
- The compiler will report a syntax error.

e. A variable **i** is of type **int**. The value of the expression `i+(!i)` is ...

- 0 or 1 depending on the value of **i**
- always 1 (one)
- always **i**
- i** or 1 depending on the value of **i**

2. Write a C program to find the sum

$$\sin(x) + \sin(2x) + \dots + \sin(Nx)$$

for the given positive integer  $N$  and given real  $x$ .

Evaluation criteria for the program will be as follows (in decremental order):

1. Relevance and correctness of mathematics
2. C syntax and programming style
3. User friendliness
4. Scope and universality (treatment of special cases; possibility to represent angle  $x$  in degrees and radians, etc.)

Provide explanations about your code as you deem necessary, either in a form of C comments or as a brief handwritten “Technical report /User’s manual”.

[Use this page for Question 2]

$$[S = \sin(x) + \sin(2x) + \dots + \sin(Nx)]$$

3. Trace execution and determine the output of the following fragment of code. (All variables are **int**).

```
1  j=1;
2  for (i=1; i<5; i++)
3  {
4      if (i<3)
5      {
6          k=20+(i%2);
7      }
8      else
9      {
10         if (j==0)
11             k=0;
12         else
13             printf(" -- ");
14         j=!j;
15     }
16     printf("%d",k);
17 }
18 printf("%d\n",i);
```

4. By taking sample nonnegative value(s) of  $x$  and tracing the code guess the purpose of the following function:

```
10 void f(int x)
11 {
12     while (x)
13     {
14         printf("%d", x%10);
15         x=x/10;
16     }
17 }
```

5. The program presented below was intended to compute the cube root  $r$  of a given positive real  $x$  to the accuracy  $10^{-6}$  by the so called bisection method. In this method, we narrow down bounds for the root step by step until the difference between the upper bound  $b$  and the lower bound  $a$  becomes less than  $10^{-6}$ . At each step we calculate the midpoint

$$m = \frac{a + b}{2}$$

and compare  $m^3$  with  $x$ . If  $m^3 < x$ , then  $\sqrt[3]{x}$  lies between  $m$  and  $b$ , — so we make  $m$  the new lower bound. Similarly, if  $m^3 > x$ , we make  $m$  the new upper bound.

The code was written in violation of good practices — all at once — and was not properly debugged. Mark syntax errors, possible mathematical errors, and style deficiencies — as many as you can find.

```

1  /* Author: Winnie The Pooh (911)123-4567*/
2  #include <stdio.h>
3  #define _eps 1.0E-6;
4
5  int main()
6  {
7  double x, r; /* input and output values */
8
9
10 printf("This program computes cube root of x\n");
11 scanf("%d", x);
12
13 /* Initialize lower and upper bounds for root */
14 a==0; /* Cube root of a positive is positive */
15 b==x; /* Cube root of x is always less than x */
16
17 /* Repeat until the bounds are close */ enough */
18 for ( b-a< _epsilon )
19 {
20     m=(b-a)/2.0;
21     if (r*r*r > x){
22 a=m
23     esle
24 b=m;
25 } /* end of for-loop */
26 r= b+a/2; /* take midpoint of the narrow interval */
27
28 /* Printing result */
29 print("r=%d, Error: r^3-x=%d\n", r*r*r-x);
30 }

```