CMPT 102 SAMPLE MIDTERM SOLUTION

PART 1 (40 points): SHORT ANSWER QUESTIONS

1. (8 points) Which of the following identifiers are invalid? Why?

int	my_book	while	loop
FOR	butter	iff	sentinel
Calc-mean	MeanOf45	UnSigned	NOT
NumOfBirds	66values	file.dat	hello

Calc-mean: identifiers can contain only alphabetic characters and digits and _. The – in this identifier is illegal
66 values: Identifiers must not start with a numeric digit
while: a keyword cannot be used as an identifier
file.dat: identifiers can contain only alphabetic characters and digits and _. The period in this identifier is illegal
int: keyword

2. (4 points) The function ***variance*** calculates the standard deviation of ***numSamples*** data values. The declaration of the ***variance*** function is

double variance(double sum, double sumsq, int numSamples);

The meanings of these variables in the function declaration are

- The sum of all data values is ***sum***
- The sum of the squares of all data values is ***sumsq***
- The number of data values ***numSamples***

Assume that double variables ***myDataSum, myDataSumSquares,*** and ***myVar*** and the integer variables ***myDataNumSamples*** and ***myVariance*** have been declared in you main function. Write a C statement to call the ***variance*** function and place the value of the variance in an appropriate (no loss of accuracy) variable

myVariance = variance(myDataSum, myDataSumSquares, myDataNumSamples);

3. (6 points) Write a for loop to add the integers 25 to 100. Assume the integer variable sum and nextInteger have been declared and initialized to zero before the loop you write is added.

```
for( nextInteger = 25; nextInteger <= 100; nextInteger++)
{
    sum += nextInteger;
}
```

4. (2 points) Write a ***printf*** statement to print the values of an integer variable Num, along with an explanatory message explaining that the value represents the number of integers that have been read.

printf("Number of integers that have been read = %d", Num);

5. (4 points) Write a ***scanf*** statements to read one long integer variable a1, one float f2, and one double f3 from a file, ***fn***, with file pointer ***filep***. The file has already been opened (***filep = fopen("fn","r");***).

fscanf(filep, "%ld %f %lf", &a1, &f2, &f3);

6. (6 points)Write an if else statement to determine if an integer is >=50, <=10 or between 10 and 50. The if –else statement should print the correct one of the following messages (no blank spaces precede any of these messages)

- `N <= 10`
- `10 < N < 50`
- `N >= 50`

```
if( N <= 10)
{
    printf("N <= 10" );
}
else if( N < 50)
{
    printf("10 < N < 50" );
}
 else
{
    printf(" N >= 50 ");
}
```

7. Shown below, between two lines of dashes are a code fragment, and the content of a data file. Based on the code fragment and the data file, answer the questions below the data file.

CODE FRAGMENT

```
/*  Declare and initialize variables.  */
int num_data_pts, k;
double time, motion, sum=0, max, min;
FILE *sensor1;

/*  Open file and read the number of data points.  */
sensor1 = fopen(FILENAME,"r");
fscanf(sensor1,"%i",&num_data_pts);

/*  Read data and compute summary information.  */
for (k=1; k<=num_data_pts; k++)
{
   fscanf(sensor1,"%lf %lf",&time,&motion);
   if (k == 1)
   {
      min = motion;
      max = motion;
   }
   sum += motion;
   if (motion > max)
    max = motion;
   if (motion < min)
    min = motion;
}
```

DATA FILE

```
4
23.5 44.6
88.0 85.2
99.0 33.2
128.0 66.8
```

a. (3 points)Before the loop begins to execute what are the values of min, max, and sum? After the code within the loop has been executed once what are the values of min, max, and sum?

Before Loop: Min and max are not declared and thus contain random values, sum has been initialized to 0

After executing body of loop once: Min = max = sum=44.6

b. (4 points)Immediately after the third set of time and motion data have been read (program stopped on the line following the fscanf statement) what are the values of k, sum, max and min.

k=3, max=85.2 min=44.6 sum= 129.8

c. (3 points)What are the values of max, min, and sum after the code fragment above has completed execution?

Min=33.2 max=85.2 sum=229.8

PART 2 (60 points): PROGRAMMING PROBLEMS

8. (35 points) Write a main program to:
   - Read a list of integers of unknown length N from a file named myinfile. The file contains only the list of integers.
   - Calculate the sum of all integers in the list,
   - Count the integers in the list
   - Calculate the sum of the squares of all integers in the list that are less than 25. Do not include the squares of integers larger than 24 in the sum of squares.
   - Count the integers in the list that are less then 25.
   - Print the number of integers in the sum with an explanatory message
   - Print the sum of all the integers with an explanatory message
   - Print the number of integers in the sum of squares with an explanatory message
   - Print the sum of the squares of the integers in the list that have values < 25 with an explanatory message

   Assume there are no errors in the data file. You need not check for the correctness of the input data. You need not check to verify that the file has been opened correctly. It is not necessary to comment your code. Output should appear on the users monitor (screen).

```
#include <stdio.h>

int main( void)
{
    /*Declare your variables */
    int NumSqData;
    int NumData;
    int Datain;
    int SumData;
    int SumSqData;
    FILE * myinfilep;

    /*Initialize your variables */
    NumSqData = 0;
    NumData   = 0;
    Datain    = 0;
    SumData   = 0;
    SumSqData = 0;
    myinfilep = NULL;

    myinfilep = fopen("myinfile","r");
    if(myinfilep == NULL)
    {
        printf(“input file could not be opened\n”);
```

```
    }

    while( 1 )
    {
      fscanf( myinfilep, "%d", &Datain );
      if( feof(myinfilep) )
      {
          break;
      }
      SumData += Datain;
      NumData++;
      if(Datain < 25)
      {
          SumSqData += (Datain * Datain);
          NumSqData++;
      }
    }
    printf("The Sum of the %d integers is: %d\n", NumData,
              SumData);
    printf("The Sum of squares of the %d integers < 25 is:%d\n",
              NumSqData, SumSqData);
     fclose(myinfilep);
     return(1);
}
```

9. (25 points) Consider two functions with the following prototypes. The prototypes are shown in bold italic type..

int Factorial(int n);

Calculates n! n*(n-1)*(n-2)*… *2*1

int Combination(int m, int r);

Calculates how many ways r objects can be chosen from m objects

The number of combinations (the number of ways r objects can be chosen from m objects) is calculated using the formula $\frac{n!}{r!(n-r)!}$

a. Write the Factorial function
b. Write the Combination function based on the equation given above. Call the factorial function from your Combination function.

Assume there are no errors in the data file. You need not check for the correctness of the input data. It is not necessary to comment your code.

```
#include <stdio.h>

int Combination( int n, int r)
{
```

```
   int Factorial(int n);
   return( Factorial(n) / (Factorial(r) * Factorial(n-r)) );
}


/* N factorial is   N*(N-1)*(N-2)**1 */
/* This function computes N! (N factorial) N>0 */
int Factorial( int n)
{
   /* declare local variables */
   int i;
   int product;

   /* initialize local variables */
   product = 1;

   for (i = n; i >1; i--)
   {
      product *= i;
   }
   return (product);
}
```