Exam is closed-book, closed-friends and closed-internet. All code has to be developed from scratch, no copy and paste. You may use your own cheat-sheet (one sheet, front and back).

Material covered: Lessons 1 - 6

0] The following fragment of code calculates the sum of all numbers from 1 to 2000:

```c
int sum = 0;
for (i=1; i<2001; i++)
    sum += i;
```

Modify it to calculate the sum of only the numbers which are multiples of 5, within the same limits. Simply add some code in the box above.

Hint: Use remainder to find out if a number is a multiple of another.

1] The program below computes the sum of all even numbers between 2 and 100. Modify it to achieve the same result using a while loop.

```c
void main(){
    int sum = 0;
    int number;
    for ( number = 2; number <= 100; number += 2){
        sum += number;
    }
    printf( "Sum is %d\n", sum );
}
```

Modified program:

2] Identify and correct the errors in the following fragments of code. Multiple errors are possible. Circle and correct on the side.

(a) ```c
    int x == 1, product == 0;
    do /*product of integers from 1 to 10*/
```
product *= x;
++x;
While (x <= 10)

(b) if (age <= 65);
      Printf("Age is greater or equal 65\n", age)
else
      Printf("Age is less than 65\n", age);

(c) if (grade = 100)
      printf ("You got a perfect score!!\n");

(d) printf("Enter next account number:");
    scanf("%f", number);

3) Find all errors (syntax and logical) in the following program. The program attempts to calculate the sum of all
numbers from 1 to 20, raised (individually) to the third power. Circle and briefly explain what the error is and how
it can be fixed.

```c
#include <stdio.h>

main() {
    int sum = 1;
    For (i=1; i<21; i++);
        sum += i*i;
}

printf("Sum of third powers is\n", sum)
return 0;
}
```

4) Explain in words what the following program computes (the program is complete and correct!):

```c
#include <stdio.h>
void main() {
    int sum = 0;
    int counter;
    for(counter = 1; counter <= 100; counter++)
        if (counter % 3)
            sum -= counter;
    printf("%i", sum);
} /* end main */
5] What is stored in the variable \( a \) by the code below?

```c
int a;

a = !(42 == 43);
```

6] What is the result of the execution of the code below?

\( a \) is an unsigned integer, already declared and initialized.

```c
if (a=42)
    printf("Number is 42\n");
else
    printf("Number is not 42\n");
```

7] Show how this recursive function is evaluated for the given values of \( n \)

```c
//Recursive fibonacci
int fibo_rec(int n){
    if ( n == 0 || n == 1 ) /* base case */
        return n;
    else /* recursive step */
        return fibo_rec(n - 1) + fibo_rec(n - 2);
}
```

- \( n = 0 \)
- \( n = 1 \)
- \( n = 2 \)
- \( n = 3 \)

8]

```c
int mystery(int a, int b) { 
    if (b == 0)
        return 0;
    else if (b % 2 == 0)
        return mystery(a + a, b / 2);
    else
        return mystery(a + a, b / 2) + a;
}
```

What is returned by \textbf{mystery(3, 12)}?
9] What does this function return?

```c
void func(float x, float y){
    unsigned int a = 0;
    a++;
    printf("%.3f \n", x + a);
    printf("%.3f \n", y + a);
}
```

10] What is the largest integer that can be represented today in the C language? Explain.

11] Write a program that does the following:
- Reads two integer numbers from the keyboard.
- Adds up the numbers.
- If the sum is positive or zero, it displays the result on the screen.
- If the sum is negative, it displays the text “NEGATIVE SUM”.

12] Write a program that does the following:
- Asks the user for a **positive** integer \( n \).
- Gets the integer from the keyboard.
- Calculates the sum \( \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + ... + \frac{1}{n} \).
- Displays the result on screen.
  Hint: Beware of integer division!

13] Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
[See larger discussion at http://blog.codinghorror.com/why-cant-programmers-program/ ]

14] The bank you're working for is developing an improved ATM, which can dispense $100, $20, $5 and $1 bills. Your job is to write a C program that does the following:
- Asks the user for an integer – let’s call it \( \text{amount} \).
- Gets \( \text{amount} \) from the keyboard.
- Breaks down \( \text{amount} \) into the fewest number of $100, $20, $5 and $1 bills.
  - Hint 1: To ensure the fewest numbers of bills, consider the denominations in decreasing order: 100 first, then 20, 5, 1.
  - Hint 2: Use integer division (/) and remainder (%).
15] Write a complete C program that calculates the product of all multiples of 3 between 1 and 25. The product starts $3 \times 6 \times 9 \times 12 \times \ldots$
Use either a \textbf{for} loop or a \textbf{while} loop. The program should print the calculated product.

16] Write a complete C program that asks the user to enter 3 integers (a, b, c), then finds and prints the largest integer. You may assume that the integers are all distinct.
Hint: Use \textbf{if} statements

17] Extra-credit: Re-write the above program using only \textbf{conditional} operators instead of \textbf{ifs}. 
Solutions

14] void main()
{
    int amount, remainder;
    int nr_100_bills, nr_20_bills, nr_10_bills, nr_5_bills, nr_1_bills;
    printf("Enter integer amount: ");
    scanf("%d", &amount);
    nr_100_bills = amount/100;
    remainder = amount % 100;
    nr_20_bills = remainder/20;
    remainder %= 20;
    nr_10_bills = remainder/10;
    remainder %= 10;
    nr_5_bills = remainder/5;
    remainder %= 5;
}

    nr_1_bills = remainder;
    printf("Amount = %d\n", amount);
    printf("$100 = %d\n", nr_100_bills);
    printf("$ 20 = %d\n", nr_20_bills);
    printf("$ 10 = %d\n", nr_10_bills);
    printf("$  5 = %d\n", nr_5_bills);
    printf("$  1 = %d\n", nr_1_bills);
}

Enter integer amount: Amount = 267
$100 = 2
$ 20 = 3
$ 10 = 0
$  5 = 1
$  1 = 2

16] void main()
{
    int a = 42, b = -100, c = 43;
    if (a<=c && b<=c)
        printf("%d\n", c);
    else if (a<=b)
        printf("%d\n", b);
    else
        printf("%d\n", a);
}

17] void main()
{
    int a = 42, b = -100, c = 43;
    printf("%d\n", (a<=c && b<=c) ? c : ((a<=b)?b:a));
}