The first midterm will cover topics upto and including functions of Chapter 4.

**Questions might include:**
Problems that require you to write a complete C++ program.
Problems that require you to write a few statements of C++.
Problems that ask you to specify the output that is produced by a C++ program.
Problems that ask you to identify and fix errors in C++ statements and programs.

The following list of problems from the Schaum’s Outline text (by Hubbard) are useful as review for the exam.

- Page 12: 1.2, 1.4, 1.5, 1.6, 1.10
- Page 13: 1.1, 1.2, 1.3
- Page 33: 2.1, 2.9, 2.10
- Page 49: 3.1, 3.2, 3.3
- Page 50: 3.5, 3.9, 3.10, 3.14
- Page 51: 3.2, 3.3, 3.6, 3.8 (without a switch statement), 3.13
- Page 80 (Review): 4.1, 4.5
- Page 81 (Problems): 4.1, 4.3, 4.4, 4.5, 4.7, 4.8, 4.12, 4.14
- Page 112 (Review): 5.1, 5.10
- Page 112 (Problems): 5.4, 5.6, 5.7, 5.9, 5.11, 5.12, 5.17, 5.20

The following problems have been used on previous midterm exams in CS111. The exam will have 4 problems.

**Problem 1** Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer \( n \).
2. If the user enters a non-positive integer for \( n \), the program terminates.
3. The program prints a rectangle of \( * \) symbols with \( n \) rows and twice as many columns as rows.

For example, if the user enters 4 for \( n \) the output is as follows:

```
********
********
********
********
```

**Answer:**

**Problem 2** Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following variables have been declared, and if necessary have values, for each part:
int number;
double x, y;

Declare any other variables that you use.

(i) Print all integers from number down to 10. For example if number is 13, the output should be 13 12 11 10. (If number < 10, nothing is printed.)
Answer:

(ii) Print the value of the sum of squares of x and y.
Answer:

(iii) Calculate x as the decimal that represents the fraction 5/7.
Answer:

(iv) Print the sum of the square roots of all the numbers from 1048576 to 5764801.
Answer:

(v) Print every three digit number \( n \) for which the next to last digit of \( n^2 \) is 2. For example, 111 is printed because 111\(^2\) = 12321. (This number ends in the digits 21 and its next to last digit is 2.)
Answer:

**Problem 3** Consider the following C++ program. What is the output from the program in response to the following user inputs?

```cpp
#include <iostream>
using namespace std;

int main () {
  int n;
  cout << "Please give me an integer: ";
  cin >> n;
  if (n < 10) {
    cout << "Integer is too small." << endl;
    if (n < 0) return 0;
  }
  if (n % 2 == 0) cout << 3 * n / 2 << endl;
  else if (n % 4 == 1) cout << 3 * ((n - 1) / 4) + 1;
  else cout << 3 * ((n + 1) / 4) - 1;
  cout << endl;
  return 0;
}
```

(a) The user enters: -9
(b) The user enters: 9
(c) The user enters: 10
(d) The user enters: 11
(e) The user enters: 21

**Problem 4** Write a complete C++ program that does the following.
1. It repeatedly, asks the user to enter an integer.
2. If the entered number is negative, the word “Negative” is printed and the program terminates.
3. Otherwise the square root of the number is calculated and the nearest integer to this square root is printed.
Here is an example of how the program should work:
Problem 5 Write a complete C++ program that does the following.
1. It asks the user to enter an integer.
2. If the entered number is even it divides the number by 2.
3. Otherwise the program multiplies the number by 3 and adds 1.
4. It prints the result.
Here is an example of how the program should work:

Enter an integer: 5
The answer is: 16

Problem 6 Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions. Assume that the following variables have been declared, and if necessary have values, for each part:

int number;
double x, y;

Declare any other variables that you use.
(i) Print all integers from 1 through number.
Answer:

(ii) Print the value of the larger of x and y.
Answer:

(iii) Calculate x as the decimal that represents the fraction 1/7.
Answer:

(iv) Print the sum of the square roots of the numbers 19683, 19684, and 19685.
Answer:

(v) Print every three digit number $n$ for which the square of $n$ ends with the digits 21. For example, 111 is printed because $111^2 = 12321$.
Answer:

Problem 7 Consider the following C++ program. What is the output from the program in response to the following user inputs?
```cpp
#include <iostream>
using namespace std;

int main () {
    int n;
    cout << "Please give me an integer: ";
    cin >> n;
    if (n < 10) {
        cout << "Integer is too small." << endl;
        if (n < 0) return 0;
    }
    if (n % 3 == 0) cout << "n = " << n << endl;
    else cout << "CSCI 111" << endl;
    while (n > 20) {
        cout << n <<", ";
        n = n - 10;
    }
    cout << endl;
    return 0;
}
```

(a) The user enters: -1
(b) The user enters: 0
(c) The user enters: 1
(d) The user enters: 19
(e) The user enters: 111

**Problem 8**  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. The program asks the user to enter a positive integer \( n \).
2. If the user enters a non-positive integer for \( n \), the program terminates.
3. The program prints a triangle with \( n \) rows whose straight vertical edge is at the right of the picture.

For example, if the user enters 4 for \( n \) the output is as follows:

```
* 
**
***
****
```

**Answer:**

**Problem 9**  Write a complete C++ program that does the following.

1. It asks the user to enter a decimal number that is greater than 0 and less than 10.
2. If the entered number is not within the desired range the program exits.
3. Otherwise the program prints the square of the number.

Here is an example of how the program should work:

Enter a number greater than 0 and less than 10: 2.5
The square is: 6.25

**Answer:**
Problem 10  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(a) Print to the screen the message:

```
2 + 2 = 5
```

(b) Print all the odd numbers from 1 to 1000 to the screen (one number per line).

(c) Ask the user enter a number that is not a multiple of 10. If the user gives an incorrect response force the user to keep entering a number until legal answer is received.

(d) Ask the user to enter a number and print its square root if it is positive. (Otherwise do not print anything.)

(e) Read an integer greater than 2 from the user, then print it in reverse. (If the user enters the number 125, the program should print 521.)

Problem 11  Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;

int main(){
    int age;
    string name;
    cout << "Please enter your name and age: ";
    cin >> name >> age;

    if (name == "Kamil") exit(0);
    if (age < 0) {
        name = "Kamil";
        age = 5;
    } 
    if (name == "Peter") {
        cout << "You rat!" << endl;
        return 0;
    } 
    if (age >= 100) {
        cout << "Goodbye Kamil!" << endl;
    }
    cout << " Hello " << name << " you are about " << age << endl;
    return 0;
}
```

(i) The user enters: Freddy 17
(ii) The user enters: Peter 19
(iii) The user enters: Kamil 19
(iv) The user enters: Andrew -20
(v) The user enters: Carl 200

Problem 12  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
The program prints a table with 100 lines of output. On output line number \( x \) the program should list the first \( x \) odd numbers.
For example, the first 4 lines of output read as follows:
Problem 13  Write a complete C++ program that asks a user to enter their day and month of birth. If the user's birthday is March 14th, the program wishes the user a Happy Birthday, otherwise it just says Hello. For example, the program could run as follows:

What is your day and month of birth: 14 March
Happy Birthday.

Problem 14  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print to the screen the message (the word Hello repeats 10 times):

Hello Hello Hello Hello Hello Hello Hello Hello Hello Hello

(b) Read an integer from the user and print the integer without its last digit. (For example if the user enters 19683, the program would print 1968.)

(c) Print the square root of 19683 to the output screen:

(d) Ask the user enter a name. If the user says Freddy, force the user to keep entering a name until something else is received.

(e) Print a random number between 1000 and 9999 to the screen.

Problem 15  Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;

int main(){
    int n, m;
    cout << "Please two integers: ";
    cin >> m >> n;

    if (n == 0 && m == 0) cout << n << endl;
    if (n == 0 || m == 0) exit(1);
    if (n < 0 && m < 0) cout << " Negative" << endl;
    else {
        if (n < m) cout << n << endl;
    }
    if (m > 7) cout << " 7" << n << endl;
    return 0;
}
```

(i) The user enters: 0 0
(ii) The user enters: 0 10
(iii) The user enters: -10 -10
(iv) The user enters: 10 -10
(v) The user enters: 10 10
Problem 16  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter an integer that is at least 3.
2. The program reads a value $x$ entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of $x$ has been entered.
3. The program prints a picture with $x$ columns. The picture should display a left pointing arrow pattern.
For example, if the user enters 4 for $x$ the program should print the following picture.

```
  *
  *
  *
  *
  *
  *
  *
```

Answer:

Problem 17  Write a complete C++ program that does the following.
1. It asks the user to enter their favorite positive integer.
2. The program prints the square root of that integer.
Here is an example of how the program should work:

Enter your favorite positive integer: 25
It has square root: 5.0

Answer:

Problem 18  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(a) Print to the screen the message:

```
2 + 2 = 4
```

(b) Print all the numbers from 1 to 1000 to the screen (one number per line).

(c) Ask the user enter a multiple of 3. If the user gives an incorrect response force the user to keep entering a number until a multiple of 3 is received.

(d) Print 10 random numbers each between 10 and 20 to the output screen:

(e) Read an integer greater than 2 from the user, then print its largest factor. (For this problem, a factor of $x$ is a number $f$ with $1 \leq f < x$ that divides into $x$ without remainder.)

Problem 19  Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.
#include <iostream>
using namespace std;

int main(){
    int n; string name;
    cout << "Please enter your name and an integer: ";
    cin >> name >> n;
    if (n == 0 && name == "Freddy") cout << name << endl;
    if (n == 0 || name == "Freddy") exit(1);
    if (n < 0) cout << " Negative" << endl;
    else {
        cout << " name " << name << " name " << endl;
    }
    if (n > 7) cout << " 7 " << endl;
    return 0;
}

(i) The user enters: Freddy 0
(ii) The user enters: Freddy 10
(iii) The user enters: Fred -10
(iv) The user enters: Fred 5
(v) The user enters: Fred 10

**Problem 20** Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
The program prints a table with 100 lines of output. On output line number \( x \) the program should list the numbers from \( x \) to \( x^2 \) together with their sum.
For example, the first 4 lines of output read as follows:

1 the sum is 1
2 3 4 the sum is 9
3 4 5 6 7 8 9 the sum is 42
4 5 6 7 8 9 10 11 12 13 14 15 16 the sum is 130

**Answer:**

**Problem 21** Write a complete C++ program that does the following.
1. It asks the user to enter the number of quarters, dimes, nickels and cents that they are carrying.
2. The program then reports the total amount of change that the user has.
Here is an example of how the program should work:

How many quarters do you have?  7
How many dimes do you have?  2
How many nickels do you have?  3
How many cents do you have ?  6
That makes 216 cents in change.

**Answer:**
**Problem 22** Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print a random number between -1 and -9 to the output screen:

(b) Print (to the output screen) the sum of the square roots of the numbers 1, 2, 3, 4, 5 and 6.

(c) Ask the user to enter the word "Hello". Force the user to keep entering a new word until an input equal to "Hello" is received.

(d) Print twelve random negative numbers.

(e) Print the largest integer whose square root is less than 1729.

**Problem 23** Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;

int main(){
    int n, m; string name;
    cout << "Please enter two integers followed by your name: ";
    cin >> m >> n >> name;

    if(n == 0) exit(1);
    if(m >= n) cout << name;
    if(m % n == 1) cout << name << name;
    else while (n > 7) {
        cout << n;
        n = n - m;
    }
    cout << endl;
    return 0;
}
```

(i) The user enters: 2 2 Freddy
(ii) The user enters: 0 7 007
(iii) The user enters: 1 10 X
(iv) The user enters: 1 2 3
(v) The user enters: 11 111 Freddy

**Problem 24** Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an odd positive integer.
2. The program reads a value \( n \) entered by the user. If the value is not legal, the program terminates.
3. The program prints an \( n \times n \) grid displaying a large letter \( X \). The left half of the \( X \) should be made with the character +, the right half should be made with the character x and the very center should be a *.

For example, if the user enters 7 for \( n \) the program should print the following picture.

```
+   x
+   x
+   x
   *
+   x
+   x
+   x
```
Problem 25  Write a complete C++ program that does the following.
1. It asks the user to enter their age (which is assumed to be a positive integer).
2. The program should print the word Hello once for each year of the user’s age.
Here is an example of how the program should work:

Enter your age: 5
Hello Hello Hello Hello Hello

Answer:

Problem 26  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(a) Print a random number that has 3 digits to the output screen:
(b) Print (to the output screen) the smallest integer whose square root is larger than 3141.5926:
(c) Ask the user to type a password and then to type it again. Print Error if the two words are different.
(d) Read a positive integer greater than 2 from the user, and print its largest factor. (For this problem a number $f$ is a factor of the number $x$ if $1 \leq f \leq x - 1$ and $f$ divides into $x$ without remainder.)
(e) Read a name from the user. If necessary, repeatedly ask the user to reenter a name until the user has said Freddy.

Problem 27  Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;

int main(){
    int n, m;
    cout << "Please enter two integers: ";
    cin >> n >> m;

    if (n > m) cout << n % m << endl;
    else {
        for (int r = 1; r < n; r++) {
            for (int c = 1; c < m - n - 1; c++) {
                cout << "*+";
            }
            cout << endl;
            if (n == 10) exit(1);
        }
        cout << endl;
        if (n == 10) exit(1);
    }
    return 0;
}
```

(i) The user enters: 10 9
(ii) The user enters: 3 7
(iii) The user enters: 3 15
(iv) The user enters: 10 15
(v) The user enters: -1 5
Problem 28  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter a positive integer.
2. If the input is illegal, the program should terminate.
3. The program prints the digits of the number in reverse order (separated by spaces) and then gives their sum.
For example, if the user enters 19683 the program should print the following output.
3 8 6 9 1 sum to 27
Answer:

Problem 29  Write a complete C++ program that does the following.
1. It asks the user to enter their age (which is assumed to be a positive integer).
2. If the user is a teenager, the program should print Hello Teenager otherwise it should just print Hello.
Here is an example of how the program should work:
Enter your age: 15
Hello Teenager
Answer:

Problem 30  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(a) Print 5 random numbers each between 1 and 9 to the output screen:
(b) Print (to the output screen) the square root of 19683:
(c) Ask the user enter a positive integer and if the user gives a non-positive response force the user to keep entering a number until a positive input is received.
(d) Read an integer greater than 2 from the user, then print its smallest factor. (For this problem, a factor of \( x \) is a number \( f \) with \( 2 \leq f \leq x \) that divides into \( x \) without remainder.)
(e) Read a name from the user and exit the program if the name is Freddy.

Problem 31  Consider the following C++ program. Write exactly what output is produced in response to the given user inputs.
```
#include <iostream>
using namespace std;

int main(){
  int n;  string name;
  cout << "Please enter your name and an integer: ";
  cin >> name >> n;

  if(n == 0) cout << name;
  if(n >= 100) exit(1);
  if(n % 5 == 1) cout << name << name;
  else while (n > 7) {
    cout << n;
    n = n - 2;
  }
  cout << endl;
  return 0;
}
```
Problem 32  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter a positive integer.
2. The program reads a value \( n \) entered by the user. If the value is not legal, the program terminates.
3. The program prints a table with \( n \) lines of output. On output line number \( x \) the program should list the numbers from 1 to \( x \) together with their sum.
For example, if the user enters 7 for \( n \) the program should print the following table.

1 the sum is 1  
1 2 the sum is 3  
1 2 3 the sum is 6  
1 2 3 4 the sum is 10  
1 2 3 4 5 the sum is 15  
1 2 3 4 5 6 the sum is 21  
1 2 3 4 5 6 7 the sum is 28

Answer:

Problem 33  Write a complete C++ program that does the following.
1. It asks the user to enter a positive integer \( x \).
2. The program reads the number entered by the user. If \( x \) is not a positive integer, the program should terminate.
3. The program prints a countdown from \( x \) to 1.
Here is an example of how the program should work:

Enter a positive integer: 5  
5 4 3 2 1

Answer:

Problem 34  Consider the following C++ program. Explain what output is produced in response to the given user inputs.
```cpp
#include <iostream>
using namespace std;

int print1(int x){
    cout << "Odd" << endl;
    return 1;
}

int print2(int x){
    cout << x*x << endl;
    return x;
}

int main(){
    int n;
    cout << "Please enter a positive integer: ";
    cin >> n;

    if(n <= 0){
        cout << "No good!" << endl; exit(1);
    }

    if (n < 10) {
        cout << n % 2 << endl; exit(0);
    }
    if (n > 11) cout << print1(n) << endl;
    if (n % 2 == 1) print2(n);
    else print1(n);
    return 0;
}
```

(i) The user enters: 0
(ii) The user enters: 9
(iii) The user enters: 10
(iv) The user enters: 11
(v) The user enters: 12

**Problem 35** Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print (to the output screen) the message: *Very Easy Question*

(b) Print (to the output screen) the square root of 11:

(c) Make the user enter 6 decimal values and print their product.

(d) The header line for a function *add3* that calculates the sum of three input integer values. (A header line is a title line, or prototype.)

(e) Print the value of a randomly selected integer between 31 and 41. (The program should make a random selection using the function *rand*. Output values of 31 and 41 are allowed.)
Problem 36  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter an even positive integer.
2. The program reads a value $n$ entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of $n$ has been entered.
3. The program prints an $n \times n$ pattern of * symbols in the shape of a large letter U.
For example, if the user enters 6 for $n$ the program should print the following picture.

```
* *
* *
* *
* *
* *
******
```

Answer:

Problem 37  Write a complete C++ program that does the following.
1. It asks the user to enter a positive integer $x$.
2. The program reads the number entered by the user. If $x$ is not a positive integer, the program should terminate.
3. The program repeatedly prints the word Hello a total of $x$ times.
Here is an example of how the program should work:

Enter a positive integer: 3
Hello Hello Hello

Answer:

Problem 38  Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```
#include <iostream>
using namespace std;

void print1(int x){
    cout << "Odd" << endl;
}

void print2(int x){
    cout << "Even" << endl;
}

int main(){
    int n;
    cout << "Please enter an integer: ";
    cin >> n;

    if(n == 0) cout << "Hello" << endl;
    if(n <= 10) cout << "Goodbye" << endl;
    if(n > 10 && n%2 == 1) print1(n);
    if(n > 10 && n%2 == 0) print2(n);
    if (n < 0) print2(n);
    return 0;
}
```
(i) The user enters: 12
(ii) The user enters: 11
(iii) The user enters: 10
(iv) The user enters: 0
(v) The user enters: -1

**Problem 39**  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(a) Print (to the output screen) the message:
*Easy Question*

(b) Print (to the output screen) a message made from the first 20 integers:
1234567891011121314151617181920

(c) Make the user enter 6 decimal values and print their sum.

(d) The header line for a function *max3* that calculates the maximum of three input decimal values. (A header line is a title line, or prototype.)

(e) Print the value of a randomly selected teen age. (The program should make a random selection using the function *rand*. A teen age is a number between 13 and 19.)

**Problem 40**  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an odd positive integer.
2. The program reads a value \(n\) entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of \(n\) has been entered.
3. The program prints an \(n \times n\) pattern of * symbols in the shape of a large letter \(T\).

For example, if the user enters 7 for \(n\) the program should print the following picture.

```
*******
*  *
*  *
*  *
*  *
*  *
```

**Answer:**

**Problem 41**  Write a complete C++ program that does the following.

1. It asks the user to enter a positive number \(x\).
2. The program reads the number entered by the user. If \(x\) is not positive, the program should terminate.
3. The program prints the square root of \(x\).

Here is an example of how the program should work:

Enter a positive number: 6.25
The square root is: 2.5

**Answer:**

**Problem 42**  Consider the following C++ program. Explain what output is produced in response to the given user inputs.
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    for (int i = 1; i <= x % 10; i++)
        cout << x << i << ".";
    cout << x/10 << endl;
}

(i) The user enters: 0
(ii) The user enters: 1
(iii) The user enters: 11
(iv) The user enters: 44
(v) The user enters: 40

Problem 43    Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(a) Print (to the output screen) the message:
2 + 2 = 4
(b) Read and store a first name, a middle initial, and a last name as entered by the user.
(c) Make the user enter 6 integer values and print the product.
(d) Print the message odd if the integer variable \( x \) stores an odd value, otherwise print the message even.
(e) Print the value of a randomly selected two digit integer. (The program should make a random selection using the function \( rand \)).

Problem 44    Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter an odd positive integer.
2. The program reads a value \( n \) entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of \( n \) has been entered.
3. The program prints an \( n \times n \) pattern in the shape of a star. The pattern should appear as a large X printed from copies of the letter X that lies over a large + printed from copies of the character +.
   For example, if the user enters 7 for \( n \) the program should print the following picture.

   \[
   \begin{align*}
   \text{X + X} \\
   \text{X + X} \\
   \text{X+X} \\
   \text{+++X+++} \\
   \text{X+X} \\
   \text{X + X} \\
   \text{X + X}
   \end{align*}
   \]

   Answer:
Problem 45  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(a) Print (to the output screen) the message:
_Problem 1(a)._ 
(b) Read and store a name as entered by the user.
(c) Print the value of the larger of two variables $x$ and $y$ each of which has type int. (For example, if $x$ is 0 and $y$ is 3, the larger value 3 is printed.)
(d) Make the user enter 10 integer values and print the sum.

Problem 46  Write a complete C++ program that does the following.
1. It asks the user to enter a positive integer $x$.
2. The program reads the number entered by the user. If $x$ is not positive, the program should terminate.
3. The program prints $x$ randomly generated dice rolls.
Here is an example of how the program should work:

Enter a positive number: 3
The dice rolled: 4 1 6

Answer:

Problem 47  The following C++ program applies 5 different functions. Supply title lines (prototypes) for the 5 functions. Do not supply any blocks of code for the functions.

```cpp
int main() {
    int x, c, r;
    x = readData();
    for (c = 0; c < 5; c++) printValues(x, c);
    x = adjust(x + 2);
    r = max3(x, c, 10);
    return fun(x + c, r - c);
}
```

(a) 
(b) 
(c) 
(d) 
(e) 

Problem 48  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter a positive integer.
2. The program reads a value $x$ entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of $x$ has been entered.
3. The program prints a triangular display which has the number $x$ on its top row. Each later row is obtained by omitting the last digit from the number on the previous row.
For example, if the user enters 19683 for $x$ the program should print the following picture.
Problem 49  Write a complete C++ program that does the following.
1. It asks the user to enter a positive even integer.
2. The program reads the number entered by the user. If the value is illegal, the program should terminate.
3. The program calculates and prints the square of the number.
Here is an example of how the program should work:

Enter a positive even number: 6
The square is 36.

Problem 50  Write C++ statements to carry out the following tasks. Do not write complete programs, just give
a single line, or a few lines of C++ instructions.
(i) Print (to the output screen) the message:
    Today is March 19, 2008.
(ii) Read and store an age entered by the user.
(iii) Print the average 2 variables $x$ and $y$ each of which has type int. (For example, if $x$ is 0 and $y$ is 3, the average
     is 1.5 and a decimal number must be printed.)
(iv) Make the user repeatedly enter a value for an integer variable $x$ until the value entered is larger than 10.

Problem 51  Consider the following C++ program. Explain what output is produced in response to the given
user inputs.
Problem 52
Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter an integer that is at least 2.
2. The program reads a value $x$ entered by the user. If the value is not legal, the program repeatedly makes the user type in another value until a legal value of $x$ has been entered. (Note legal means greater than 1.)
3. The program prints a picture with $x$ rows. The first row should show the first $x$ positive integers, the next row the first $x-1$ positive integers, until eventually the last row shows only the number 1.

For example, if the user enters 5 for $x$ the program should print the following picture.

```
12345
1234
123
12
1
```

Answer:

Problem 53
Consider the following C++ program. Explain what output is produced in response to the given user inputs.
```cpp
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x <= 100) {
        cout << x;
    } else {
        cout << x/100 << x%10 << endl;
    }
    return 0;
}
```

(i) The user enters: -50
(ii) The user enters: 0
(iii) The user enters: 99
(iv) The user enters: 456
(v) The user enters: 4560

**Problem 54** Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the message:
   *Easy!*

(ii) Read and store a name entered by the user.

(iii) Print the value of the larger of 2 variables \( x \) and \( y \) each of which has type double.

(iv) Print the difference between 2 variables \( a \) and \( b \) each of which has type int. (The printed difference should not be negative. For example the difference between 4 and 7 is 3, so too is the difference between 7 and 4.)

**Problem 55** Write a complete C++ program that does the following.

1. It asks the user to enter a positive number.
2. The program reads the number entered by the user. If the value is not positive, the program should terminate.
3. The program calculates and prints the last digit of the entered number.

Here is an example of how the program should work:

Enter a positive number: 56
last digit is 6.

**Answer:**
Problem 56
Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, \( x \).
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of \( x \) has been entered. (Note positive means greater than 0.)
3. The program prints an \( x \times x \) rectangle outlined with * symbols.

For example, if the user enters 5 for \( x \) the program should print the following pattern.

```
*****
* * *
* * *
* * *
*****
```

Answer:

Problem 57  The following C++ program is supposed to ask a user to enter their name and date of birth. It then greets the user and wishes a happy birthday if it is the user’s birthday. The program has a number of errors. Rewrite the program to fix the errors.

```cpp
#include <iostream>
#include <string>
using namespace std;

int main() {
    cout << "Enter your name and the month, day, and year of your birth: "
    int name, month, day, year;
    cin >> name >> day >> month >> year;
    cout << "Hello name" endl;
    if (month = 3 || day = 14) {
      cout "Happy birthday" endl;
    }
}
```

Problem 58
Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)

1. It asks the user to enter a positive integer value, \( x \).
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of \( x \) has been entered. (Note positive means greater than 0.)
3. The program calculates and prints out \( x^x \). (The value of \( x^x \) is \( x \times x \times x \times \ldots \times x \), a product of \( x \) copies of the number \( x \).)

Problem 59  Consider the following C++ program. Explain what output is produced in response to the given user inputs.

```cpp
#include <iostream>
using namespace std;
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
```
cout << "Illegal" << endl;
exit(1);
}
while (x > 0) {
    cout << x % 10;
    x = x / 10;
}
cout << x << endl;
}

(i) The user enters: -50
(ii) The user enters: 7
(iii) The user enters: 467
(iv) The user enters a positive integer. (Explain how the output is related to the integer that the user enters.)

Problem 60  The following C++ program is supposed to ask a user to enter three different integers. It then
prints the middle value of the three input numbers. (For example, if the user types 10 5 15, the program should
print 10.) The program has several errors. Rewrite the program to fix the errors and arrange the program so that
it is easier for a human to read.

#include <iostream>
using namespace std;
int main
{
    int x, y, z;
    cout << "Enter three different integers: " << endl;
    cin >> "x" >> "y" >> "z" << endl;
    if ((x > y > z) && (z > y > x)); cout << y;
    if ((y > x > z) && (z > x > y)); cout << x;
    if ((z > y > x) && (x > y > z)); cout << y; return;
};

Problem 61
Write a complete C++ program that does the following.
1. It asks the user to enter a positive integer value, x.
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the
user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)
3. The program prints out a triangle with x rows that points downwards. For example, if the user enters 3 for x the
program should print:

    ***
    **
    *

Problem 62  Consider the following C++ program. Write the exact output that is produced in response to the
given user inputs.
```cpp
#include <iostream>
using namespace std;

int fun(int a) {
    int b;
    b = a / 10;
    return b;
}

int main() {
    int x, y;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    y = fun(x);
    cout << x << y << endl;
    return 0;
}
```

(i) The user enters: -50
(ii) The user enters: 7
(iii) The user enters: 467

**Problem 63** Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.

(i) Print (to the output screen) the greeting:

*Hello. This is an easy question.*

(ii) Get the user to enter their first name, which is to be stored as the variable `name`.

(iii) Print the sum of the numbers from 1 to 1000 onto the screen. (The output should be the value of $1 + 2 + \ldots + 999 + 1000$).

(iv) Get the user to enter an integer value. Print the message *POSITIVE* if it is greater than zero, or *NEGATIVE* if it is less than zero. Do not take any action if the user enters zero.

**Problem 64** Consider the following C++ program. Explain what output is produced in response to the given user inputs.
#include <iostream>
using namespace std;
void multiPrint(int y) {
    for (int i = 1; i <= y; i++)
        cout << y << "!";
    return;
}
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x > 2) multiPrint(x);
    cout << x << endl;
    return 0;
}

(i) The user enters: -50
(ii) The user enters: 1
(iii) The user enters: 4

Problem 65  Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter their 4 digit id number.
2. The program reads the number entered by the user and stores it as the variable $x$. If the value of $x$ is not in the range from 1000 to 9999, the program repeatedly makes the user type in another number until a proper id number has been entered.
3. The program calculates and prints out the last digit of the id number.

For example: A typical interaction with a user might be as follows. (The user responses are shown as bold.)
Enter your 4 digit id: 56789
Illegal, try again: 25
Illegal, try again: 9995
The last digit of your id is 5.

Problem 66  Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(i) Print (to the output screen) the greeting:
(ii) Get the user to enter their age, which is to be stored as the variable age.
(iii) Get the user to enter a positive integer value. Exit if the user enters a non-positive value, otherwise: Print the message EVEN if the value is even, or ODD if it is odd.
(iv) Get the user to enter a name. If the user enters the name Freddy, tell the user to enter a different name and force the user to re-enter a name until it is different from Freddy.

Problem 67  Consider the following C++ program. Explain what output is produced in response to the given user inputs.
int main() {
    int x;
    cout << "Enter a positive integer: ";
    cin >> x;
    if (x <= 0) {
        cout << "Illegal" << endl;
        exit(1);
    }
    if (x < 10) cout << x--;
    else {
        if ((x % 10) == 0) cout << x / 10;
        cout << x * 10;
    }
    cout << endl;
}

(i) The user enters: -50
(ii) The user enters: 0
(iii) The user enters: 9
(iv) The user enters: 456
(v) The user enters: 4560

Problem 68
Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter a positive integer value, x.
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of x has been entered. (Note positive means greater than 0.)
3. The program prints a triangular pattern that is x rows high. The characters 0 and 1 are used to print the pattern. Odd numbered rows are printed using a 1 and even numbered rows are printed using a 0.
For example, if the user enters 4 for x the program should print the following pattern with 4 rows.

1
00
111
0000

Answer:

Problem 69   Write C++ statements to carry out the following tasks. Do not write complete programs, just give a single line, or a few lines of C++ instructions.
(i) Print (to the output screen) the greeting:
Hello.
(ii) Get the user to enter their age. Then print out whichever the following messages applies:
You are over 25
You are not over 25
(iii) Ask the user to enter an even number.
Make the user re-enter the number as often as is needed until the number is even.
(iv) Print the average value of 3 variables x, y, and z each of which has type double.
(v) Calculate and print the decimal that represents the fraction \(\frac{1}{5}\).
Problem 70  Write a complete C++ program that does the following.
1. It asks the user to enter a number of cents that is between 0 and 99.
2. The program reads the number entered by the user. If the value is not in the right range, the program should terminate.
3. The program calculates and prints out the most efficient combination of quarters, nickels, dimes, and pennies that provide the sum entered by the user.
Here is an example of how the program should work:

How many cents? 57
quarters: 2
dimes: 0
nickels: 1
pennies: 2

Answer:

Problem 71
Write a complete C++ program that does the following. (Programs that correctly carry out some of the tasks will receive partial credit.)
1. It asks the user to enter a positive integer value, \( x \).
2. The program reads a value entered by the user. If the value is not positive, the program repeatedly makes the user type in another value until a positive value of \( x \) has been entered. (Note positive means greater than 0.)
3. The program prints an \( x \times x \) square pattern of \(*\) symbols in such a way that rows and columns are separated by rows and columns of \(-\) symbols.
For example, if the user enters 3 for \( x \) the program should print the following pattern (there are 3 rows and 3 columns that contain \(*\)'s, but there are other rows and columns with only \(-\)'s).

```
*---*
-----
*---*
-----
*---*
```

Answer: