```
        cout << "After call to add_tax\n"
             << "tax_rate is " << tax_rate << endl
             << "cost is " << cost << endl;

        cout << "Test again?"
             << " (Type y for yes or n for no): ";
        cin >> ans;
        cout << endl;
    } while (ans == 'y' || ans == 'Y');

    return 0;
}

void add_tax(double tax_rate, double& cost)
{
    cost = cost + ( tax_rate/100.0 )* cost;
}
```

21. A stub is a simplified version of a function that is used in place of the function so that other functions can be tested.

22. //THIS IS JUST A STUB.

```
double rain_prob(double pressure, double humidity, double temp)
{
    return 0.25; //Not correct, but good enough for some testing.
}
```

23. assert(z != 0).

24. A debugger is a tool that allows the programmer to set breakpoints, step through the code line by line, and inspect or modify the value of variables.

25. Keeping an open mind, adding cout statements to narrow down the cause of the error, using a debugger, searching for common errors, and devising a variety of tests are a few techniques that you can use to debug a program.

PROGRAMMING PROJECTS

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1. Write a program that converts from 24-hour notation to 12-hour notation. For example, it should convert 14:25 to 2:25 PM. The input is given as two integers. There should be at least three functions, one for input, one to do the conversion, and one for output. Record the AM/PM information as a value of whether it is AM or PM. (The function will have other Include a loop that lets the user repeat this computation again and again until the user says he or she wants to er

2. Write a program that uses the fundamental idea of Eucli is one of the oldest known algorithms, for calculating t divisor of two numbers using a function. If p and q a gcd() function will perform the calculation in the foll

```
gcd(p,0) = p
gcd(p,q) = gcd(q, p%q)
```

3. Write a program to find the factorial of a number u example, the factorial of 5 = 5 x 4 x 3 x 2 x 1 = 120.

4. Write a program that computes the "to the power" ca number, where the base and exponent are given by the should take two integers, one for the exponent, and a You should use three functions: one for input, anoth culation, and another for output. The calculation fun parameters: one for the exponent, and another for the

5. Write a program that tells what coins to give out for ar from 1 cent to 99 cents. For example, if the amount is would be something like the following:

```
86 cents can be given as
3 quarter(s) 1 dime(s) and 1 penny(pennies)
```

Use coin denominations of 25 cents (quarters), 10 cent (pennies). Do not use nickel and half-dollar coins. Yo the following function (among others):

```
void compute_coins(int coin_value, int& num, i
//Precondition: 0 < coin_value < 100; 0 <= am
//Postcondition: num has been set equal to th
//of coins of denomination coin_value cents th
//from amount_left. Additionally, amount_left
//by the value of the coins, that is, decreas
//num * coin_value.
```

For example, suppose the value of the variable amou after the following call, the value of number will b amount_left will be 11 (because if you take 3 quarte leaves 11 cents):

```
compute_coins(25, number, amount_left);
```

```
>> cost >> tax_rate;
tax(tax_rate, cost);

 << "After call to add_tax\n"
 << "tax_rate is " << tax_rate << endl
 << "cost is " << cost << endl;

 << "Test again?"
 << " (Type y for yes or n for no): ";
>> ans;
 << endl;
(ans == 'y' || ans == 'Y');

;


(double tax_rate, double& cost)

ost + ( tax_rate/100.0 )* cost;
```

plified version of a function that is used in place of the function her functions can be tested.

```
ST A STUB.
rob(double pressure, double humidity, double temp)

.25; //Not correct, but good enough for some testing.


0).
```

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PROJECTS

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m that converts from 24-hour notation to 12-hour notation. t should convert 14:25 to 2:25 PM. The input is given as two should be at least three functions, one for input, one to do the

type char, 'A' for AM and 'P' for PM. Thus, the function for doing the conversions will have a call-by-reference formal parameter of type char to record whether it is AM or PM. (The function will have other parameters as well.) Include a loop that lets the user repeat this computation for new input values again and again until the user says he or she wants to end the program.

2. Write a program that uses the fundamental idea of Euclid's algorithm, which is one of the oldest known algorithms, for calculating the greatest common divisor of two numbers using a function. If p and q are the numbers, the gcd() function will perform the calculation in the following manner:

```
gcd(p,0) = p
gcd(p,q) = gcd(q, p%q)
```

3. Write a program to find the factorial of a number using a function. For example, the factorial of 5 = 5 x 4 x 3 x 2 x 1 = 120.

4. Write a program that computes the "to the power" calculation of a given number, where the base and exponent are given by the user. Your program should take two integers, one for the exponent, and another for the base. You should use three functions: one for input, another for exponent calculation, and another for output. The calculation function must take two parameters: one for the exponent, and another for the base.

5. Write a program that tells what coins to give out for any amount of change from 1 cent to 99 cents. For example, if the amount is 86 cents, the output would be something like the following:

```
86 cents can be given as
3 quarter(s) 1 dime(s) and 1 penny(pennies)
```

Use coin denominations of 25 cents (quarters), 10 cents (dimes), and 1 cent (pennies). Do not use nickel and half-dollar coins. Your program will use the following function (among others):

```
void compute_coins(int coin_value, int& num, int& amount_left);
//Precondition: 0 < coin_value < 100; 0 <= amount_left < 100.
//Postcondition: num has been set equal to the maximum number
//of coins of denomination coin_value cents that can be obtained
//from amount_left. Additionally, amount_left has been decreased
//by the value of the coins, that is, decreased by
//num * coin_value.
```

For example, suppose the value of the variable amount_left is 86. Then, after the following call, the value of number will be 3 and the value of amount_left will be 11 (because if you take 3 quarters from 86 cents, that leaves 11 cents):