Submitted by

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Tutor: Wolfgang Fuhl   April 12, 2021

Summer Semester 2021
Programming in C/C++ − Solution of Exercise 1
Deadline: 13. April, 8:00 Uhr

Exercise 1.1 *Error Messages* [5 Points]

In all cases the program will produce compiler errors.

a)

b)

c)

d)

e)

Exercise 1.2 *Type conversion* [7 Points]

a)

```
l = i;
```

This operation is absolutely safe as long is a 8-byte integer data type and can hold the 4-byte int.

b)

```
i = l + 90;
```

This operation is risky because of the opposite reason as in *a)*. The 4-byte `int` do not have enough space to hold a 8-byte value. There can occur an overflow exception if the `long` value exceeds 4-bytes.

c)

```
d = f;
```

This is safe as `double` is a 8-byte floating-point data type and can hold a 4-byte floating-point value.

d)

```
f = s;
```

This operation is safe as float can hold all values from a short.

e)

```
b = d;
```

This is very risky as a `char` is a integer data type and can store 1 byte of information and a `double` is a floating-point type with up to 8 bytes. This will likely produce unexpected behavior.

f)

```
a = i;
```

As stated in *e*) the `char` datatype can hold 1 byte of information and a `int` can exceed this range.

g)

```
i = d;
```

Firstly this will lead to a loss of precision as `int` is an integer value and secondly this can produce an overflow exception as `double` exceeds the range of an `int`.

Exercise 1.3 *Solving quadratic equation* [10 Points]

If the user sets $a = 0$ the function will solve the linear equation instead.

```cpp
void midnightEq() {
    double a,b,c;
    cout << "Enter a number 'a': ";
    cin >> a;
    cout << "Enter a number 'b': ";
    cin >> b;
    cout << "Enter a number 'c': ";
    cin >> c;

    if(a == 0) {
        cout << "Input could be reduced to a linear equation." << endl;
        cout << "x = " << -c/b << endl;
    } else {
        double sqrtPart = b * b - 4 * a * c;

        if (sqrtPart < 0.)
            cout << "no solution" << endl;
        else {
            cout << "x1 = " << (-b + sqrt(sqrtPart)) / (2 * a) << endl;
            cout << "x2 = " << (-b - sqrt(sqrtPart)) / (2 * a) << endl;
        }
    }
}
```

Exercise 1.4 *Running through an algorithm* [10 Points]

$$ggT(a,b) = \begin{cases} a, & a = b \\ ggT(a-b,b), & a > b \\ ggT(a,b-a), & a > b \end{cases}$$

The function above will be evaluated as follows for the values $a = 65$, $b = 25$:

```
ggt(65,25)  →   65 > 25:  ggT((65-25) = 40, 25)
                40 > 25:  ggT((40-25) = 15, 25)
                15 < 25:  ggT(15, (25 - 15) = 10)
                15 > 10:  ggT((15-10) = 5, 10)
                5 < 10:   ggT(5, (10 - 5) = 5)
                5 = 5:    5
```