



# inMusic

## Software Developer C++/Audio Test

### Introduction

The following series of questions have no specific right or wrong answer.

We want to see how you approach the problems presented.

Some of the questions below are intentionally vague. Please state any assumptions you make when formulating your answers.

#### NOTE

This test is intended to take only a few hours to complete. Please don't feel obliged to spend too long on it!

### Question One

Write a function that, given some numbers, returns the arithmetic mean of them.

Demonstrate it working.

### Question Two

You are writing JUnit-style test framework.

The test method names take the form:

```
public void testCowsCanBeMilked()  
public void testSheepAreNotTheOnlyFruit()
```

When we report a test running, the name is displayed the name in English, thus:

"Cows can be milked"

"Sheep are not the only fruit"

In C++, write a function that parses the method signature and returns the equivalent display version.

Demonstrate it working. Well.

### Question Three

Suppose we have a C++ class called `widget` defined in `widget.h`:

```
class widget
{
    ...
};
```

The definition of the class `fubar` may depend on `widget` in many ways. Here are sixteen:

```
class fubar : public widget // 1
{
    void value_parameter(widget ); // 2
    void ref_parameter(widget &); // 3
    void ptr_parameter(widget *); // 4

    virtual void value_parameter(widget ); // 5
    virtual void ref_parameter(widget &); // 6
    virtual void ptr_parameter(widget *); // 7

    widget value_return(); // 8
    widget & ref_return(); // 9
    widget * ptr_return(); // 10

    widget instance_value_member; // 11
    widget & instance_ref_member; // 12
    widget * instance_ptr_member; // 13

    static widget static_value_member; // 14
    static widget & static_ref_member; // 15
    static widget * static_ptr_member; // 16
};
```

Which of these require a `#include`:

```
#include "widget.hpp"
```

as opposed to a forward declaration:

```
class widget;
```

State any interesting reasons why.

What other ways might `fubar` depend on `widget`, and how does this relate to header dependency?

### Question Four

A colleague has presented the following code to you for review. What comments would you feed back to the author, and what would be the outcome of your review?

```
class FileStarError
{
public:
    FileStarError(const char *e)
    {
        message=e;
    }

    const char *what() { return message; }
```

```

    const char *message;
};

class FileStar
{
public:
    FileStar(const char *fn, const char *m="r")
    {
        filename=strdup(fn);
        f=fopen(fn,m);

        if (f==NULL)
        {
            throw FileStarError("Error opening file");
        }
    }

    ~FileStar()
    {
        delete [] filename;
        if (fclose(f)<0)
        {
            throw FileStarError("Error closing file");
        }
    }

    void read(char *buf, int size)
    {
        if (fread(buf, 1, size, f)!=size)
        {
            throw FileStarError("Error reading from file");
        }
    }

    const char *filename;
    FILE *f;
};

```

### Question Five

In a real-time audio application, the software needs to react to control changes (e.g. change the sound) immediately.

Some operations, for example time-stretching, need a lot of pre-calculations, that can typically take 100s of milliseconds.

What general concepts come to your mind to deal with this situation?

### Question Six

How would you measure the *true* (inter-sample) peak level of a digital signal?

### Question Seven

Design (basic UML-like shapes) an architecture for a program that can:

- use one of the installed audio devices on a system
- pass audio through a mixer component
- load plugins into the mixer

## Document information

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