

1 Introduction

Here are a few notes of questions I've been asked in a series of interviews for technical roles. Almost all of these questions are from interviews in financial institutions, mostly in London. The purpose of this document is to give an idea of the range of questions that may be asked in a technical interview. There are of course many other factors that are important, like how you answer questions you don't know, presentation, confidence, communication, etc. which are not addressed here.

There are a lot of questions that are much harder to describe than a couple of sentences on paper, due to the interviewer leading you through a scenario and seeing what conclusions you make at each stage. Other common questions you get in such interviews include testing, how you test your code (or someone else's code), what to do when the code fails, etc. Sometimes other general software engineering processes are touched upon.

Be prepared to talk about low-level understanding of garbage collection in Java (or possibly C#) as this was another common line of interview questioning. An understanding of general garbage collection algorithms is useful here. Finding bugs in a snippet of code is very common, often code will be riddled with many bugs and you are judged on how many you find. In C++, you'll want to understand things like returning references to local variables, mixing new/delete and malloc/free, implementing copy constructors but not operator=, not checking pointers for NULL, etc.

2 General brain teasers

2.1 Coins on a table

Two players, each have infinitely many pound coins. All coins are the exact same size. One round table. A player places a coin on the table during his turn, it is then his opponent's turn. If a player cannot place a coin on the table without it stacking on top of another coin or moving another coin already on the table, that player loses.

What three strategies or ideas are necessary to win this game for any sized round table?

2.2 Cube chopped in half

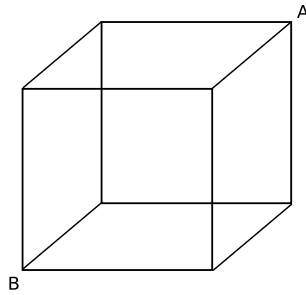
A cube is held so it is exactly balanced on one corner. If I cut the cube half-way up parallel to the ground, what shape are the resulting new faces?

2.3 Ladder question

I have a ladder with a number of rungs. I have 2 plates. I want to find the highest rung on the ladder I can drop a plate from such that the plate does not break. If I drop a plate from too high on the ladder, it will break. What is the minimum amount of rungs I can drop plates from such that I guarantee I know the correct answer?

2.4 Travelling on a cube

I have a wireframe cube as shown below. I want to travel from point A to point B.



- What is the minimum amount of edges I can traverse to reach my goal?
- How many ways can I get to the goal taking this number of steps?
- How many ways can I get to the goal with an extra one step?
- How many ways can I get to the goal with an extra two steps? Three? N?

2.5 Prime numbers

Is 139 a prime number?

Given the answer to the above, tell me if 143 is a prime number.

2.6 Weighing balls

I have 8 balls I wish to weigh on old fashioned scales — the type that I can weigh two sides against each other and see if one side is heavier than the other. One of the 8 balls weighs more than the other 7, how can I determine which ball this is in the minimum number of weighs?

3 Mathematical problems

3.1 Differentiation and maximisation

- Differentiate x^x .
- Sketch the function $y = x^{1/x}$ and then find its maximum.

4 Technical and C++ questions

4.1 General coding

- Write code in basic C or C++ without any STL to reverse a string in place.
This is the most common question asked by far.
- How might I use my function above to reverse the order of the words in a string?

4.2 C++

- Explain the following code:

```
typedef void * (A:: *B) (char *);
```

- Explain the different cast operators in C++.
- Why should destructors be virtual?
- What is “object splicing”?
- Discuss throwing exceptions in a destructor.
- You are implementing a basic smart pointer class. You are given a base class that implements increase and decrease reference functions and has the pointer that is managed. Given that you are deriving from this class, what operations/functions might you add to make your smart pointer generally useful?
- You are appointed to work on a pre-existing system that is using a lot of memory over time, so much so that the traders are required to restart their Excel spreadsheets (the system is an Excel add-in) every day. Discuss the methodology you would use to find and solve the problem. If any debugging tools you use do not report any obvious problems, what might the problem be and how would you solve it?
- Explain the “virtual constructor” concept.
- Explain the “singleton” concept and discuss why complex designs are used.
- Explain the difference in the pre- and post-increment operators, especially with respect to operator overloading in user defined types.
- What is the difference between an STL set and an STL map? How might these data structures be implemented? What do you need to implement in your classes are that used in a set?
- What happens in the following code?

```
class A
{
public:
    virtual void stuff(int i = 5) { cout << i << endl; }
};

class B : public A
{
public:
    virtual void stuff(int i = 10) { cout << i << endl; }
};

int main(int argc, char *argv[])
{
    A *a = new B();
}
```

```

        a->stuff();

        return 0;
    }

```

- Explain the following keywords in C++: **const**, **mutable**, **explicit**, **auto**.
- Discuss the order of constructors and destructors called in the following code:

```

class A
{
    A() { /* Will throw an exception the third time it is called */
        }
    ~A() { /* ... */ }
};

class B
{
public:
    B() { /* ... */ }
    ~B() { /* ... */ }

    A a1;
    A a2;
    A a3; // Will throw an exception in constructor
    A a4;
};

int main()
{
    try {
        B my_b;
    } catch(...) {
    }
    return 0;
}

```

- What is Boost? If you have used it, which parts?

4.3 General

- What is a shared library? What is different between a shared library on UNIX and on Windows?
- Define deadlock.
- Given the definition of deadlock, how might you modify the code to prevent the deadlock? Give as many designs as possible.

5 Finance and economics questions

- You have control over interest rates and inflation is very high in your country. What might you do with your interest rates?
- I own a long call option. Draw a graph of the option's value at maturity time on the Y-axis and the underlying (stock) price on the x-axis. The strike price is somewhere on the middle of the x-axis, pick an arbitrary point.
Given some basic information on the stock price, draw a line of the options value one month away from maturity.
- 1 year interest rates are 5% and 2-year interest rates are 5.5%. What is the market saying about 1 year interest rates in a years time?

6 General questions

- Explain numerical integration.
- Explain numerical differentiation.
- Explain the Newton-Raphson method.