

## Computer Science Interview Questions

1. What can you tell me about binary searches and their efficiency?
2. It is a fact that, apart from the peripherals, the whole of a computer can be made from NAND gates. The Egyptians created NAND gates using marbles rolling down chutes and used them for booby trapping pyramids. Did, then, the Egyptians invent the computer?
3. Can you explain the principle of the global positioning system (GPS)? What factors contribute to its accuracy?
4. A group of 7 pirates has 100 gold coins. They have to decide amongst themselves how to divide the treasure, but must abide by pirate rules: 1) The most senior pirate proposes the division. 2) All of the pirates (including the most senior) vote on the decision. If half or more vote for the division, it stands. If less than half vote for it, they throw the most senior pirate overboard and start again. 3) The pirates are perfectly logical, and entirely ruthless (only caring about maximising their own share of the gold). What division should the most senior pirate suggest to the other six?
5. You are given 10 boxes, each large enough to contain exactly 10 wooden building blocks, and a total of 100 blocks in 10 different colours. There may not be the same number in each colour, so you may not be able to pack the blocks into the boxes in such a way that each box contains only one colour of block. How could you fill the boxes so that each box contains at most two different colours?
6. What happens when light has to pass through a medium denser than air?
7. The real-valued function  $f(x)$ , defined for  $0 \leq x \leq 1$ , has a single maximum at  $x = m$ . If  $0 \leq u < v \leq m$  then  $f(u) < f(v)$ , and if  $m \leq u < v \leq 1$  then  $f(u) > f(v)$ . You are told nothing else about  $f$ , but you may ask for the value of  $f(x)$  for any values of  $x$  you choose. How would you find the approximate value of  $m$ ? How accurately could you find  $m$  if you could choose only 10 values of  $x$  for which to evaluate  $f(x)$ ?
8. What is the fundamental difference between a spreadsheet and a database?
9. Jill bets Jack that she can do the following trick. Jack will recite 99 different numbers from 1 to 100 in a random order, and she will be able to name the only number in that range that he didn't say. Jill cannot take any notes or write anything down. What is the best way for Jill to perform the trick, and can you write down a formula to express your answer?
10. Why is the number 2.7182818... used in mathematics?
11. You are locked in a room with your worst enemy. On a table in the centre of the room is a bar of chocolate, divided into squares in the usual way. One square of the chocolate is painted with a bright green paint that contains a deadly nerve poison. You and your enemy take it in turns to break off one or more squares from the remaining chocolate (along a straight line) and eat them. Whoever is left with the green square must eat it and die in agony. You may look at the bar of chocolate and then decide whether to go first or second. What is your strategy?
12. There are 10 people sat around a circular table. Each person is assigned a different number from 1 to 10 inclusive. Can you show that there is at least one group of 3 people sitting next to each other whose numbers sum to 17 or more?
13. An urn contains 23 white beans and 34 black beans. A monkey takes out two beans; if they are the same, he puts a black bean into the urn, and if they are different, he puts in a white bean from a large heap he has next to him. The monkey repeats this procedure until there is only one bean left. What colour is it?
14. Eleven lily pads are numbered from 0 to 10. A frog starts on pad 0 and wants to get to pad 10. At each jump, the frog can move forward by one or two pads, so there are many ways it can get to pad 10. For example, it can make 10 jumps of one pad, 1111111111, or five jumps of two pads, 22222, or go 221212 or 221122, and so on. We'll call each of these ways

different, even if the frog takes the same jumps in a different order. How many different ways are there of getting from 0 to 10?

15. What feature/property of logarithms and exponentials means that they preserve inequalities?
16. Imagine you are given a list of slightly less than 1,000,000 numbers, all different, and each between 0 and 999,999 inclusive. How could you find (in a reasonable time) a number between 0 and 999,999 that is not on the list?
17. Just by describing your approach, how would you show that exponentials are larger than linear expressions for large input values?
18. The game of Scribble is played with an inexhaustible supply of tiles, and consists of forming 'words' according to certain rules. Since each tile bears one of the letters P, Q, or R, these are not words that will be found in an ordinary dictionary. The game begins with the word PQ on the board; each move consists of applying one of the following rules: If the word on the board is Px, for some shorter word x, you may change it to Pxx. For example, if the word is PQRRQ then you may change it to PQRRQQRRQ. If the word on the board is xQQQy, for some shorter words x and y, then you may change it to xRy, replacing the sequence QQQ with a single R. If the word on the board is xRRy, for some shorter words x and y, then you may change it to xy, deleting the sequence RR entirely. (i) For each of the following words, say whether you can make it or not by following the rules of the game: QPR, PQQ, PQR, PR. (ii) Given any word, how can you decide whether it can be made or not?