Microsoft Sample Paper

Jobs-Junction.com

Company	:	Microsoft
Date	:	
College	:	

1. Given a rectangular (cuboidal for the puritans) cake with a rectangular piece removed (any size or orientation), how would you cut the remainder of the cake into two equal halves with one straight cut of a knife ?

2. You're given an array containing both positive and negative integers and required to find the subarray with the largest sum (O(N) a la KBL). Write a routine in C for the above.

3. Given an array of size N in which every number is between 1 and N, determine if there are any duplicates in it. You are allowed to destroy the array if you like. [I ended up giving about 4 or 5 different solutions for this, each supposedly better than the others]. How about finding both numbers – the duplicate and the missing?

4. Write a routine to draw a circle ($x ** 2 + y ** 2 = r ** 2$) without making use of any floating point computations at all. [This one had me stuck for quite some time and I first gave a solution that did have floating point computations].

5. Given only putchar (no sprintf, itoa, etc.) write a routine putlong that prints out an unsigned long in decimal. [I gave the obvious solution of taking % 10 and / 10, which gives us the decimal value in reverse order.

This requires an array since we need to print it out in the correct order.

The interviewer wasn't too pleased and asked me to give a solution which

didn't need the array].

6. Give a one-line C expression to test whether a number is a power of

2. [No loops allowed - it's a simple test.]

7. Given an array of characters which form a sentence of words, give an

efficient algorithm to reverse the order of the words (not characters)

in it.

8. How many points are there on the globe where by walking one mile south,

one mile east and one mile north you reach the place where you started.

9. Give a very good method to count the number of ones in a 32 bit number.

(caution: looping through testing each bit is not a solution).

10. What are the different ways to say, the value of x can be either a 0

or a 1. Apparently the if then else solution has a jump when written

out in assembly.

```
if (x == 0)

        y=0

else

        y =x
```

There is a logical, arithmetic and a datastructure soln to the above

problem.

11. Reverse a linked list. (singly-linked, doubly-linked, …) Can u reverse a singly linked list using only two pointers?

13. In an X's and 0's game (i.e. TIC TAC TOE) if you write a program for this   give a fast way to generate the moves by the computer. I mean this should   be the fastest way possible. The answer is that you need to store all possible configurations of the board and the move that is associated with that. Then it boils down to just accessing the right element and getting the corresponding move for it. Do some analysis and do some more optimization in storage since otherwise it becomes infeasible to get the required storage in a DOS machine.

14. I was given two lines of assembly code, which found the absolute value of a number stored in two's complement form. I had to recognize what the code was doing. Pretty simple if you know some assembly and some   fundamentals on number representation.

15. Give a fast way to multiply a number by 7.

16. How would go about finding out where to find a book in a library. (You do not know how exactly the books are organized beforehand).

18. Tradeoff between time spent in testing a product and getting into the market first.

19. What to test for given that there isn't enough time to test everything you   want to.

20. First some definitions for this problem:

   a) An ASCII character is one byte long and the most significant bit

      in the byte is always '0'.

   b) A Kanji character is two bytes long. The only characteristic of a

      Kanji character is that in its first byte the most significant bit

      is '1'.

    Now you are given an array of a characters (both ASCII and Kanji) and, an index into the array.

    The index points to the start of some character. Now you need to write a function to do a backspace (i.e. delete   the   character before the given index).

 21. Delete an element from a doubly linked list (which kind? with a dummy   header or without?)

 22. Write a function to find the depth of a binary tree.

23. Given two strings S1 and S2. Delete from S2 all those characters which

occur in S1 also and finally create a clean S2 with the relevant chars deleted. (ref. e12.cpp)

24. Assuming that locks are the only reason due to which deadlocks can occur in a system. What would be a foolproof method of avoiding deadlocks in the system.

25. Reverse a linked list??? Question still remains …

26. Write a small lexical analyzer - interviewer gave tokens. expressions like

"a*b" etc.

27. Besides communication cost what is the other source of inefficiency in RPC?

answer : context switches, excessive buffer copying).

How can you optimise the communication? (ans : communicate through shared

memory on same machine, bypassing the kernel _ A Univ. of Wash. thesis)

28. Write a routine that prints out a 2-D array in spiral order!

29. How is the readers-writers problem solved? - using semaphores/ada .. etc.

30. Ways of optimizing symbol table storage in compilers.

31. A walk-through through the symbol table functions, lookup() implementation

etc - The interv. was on the Microsoft C team.

32. A version of the "There are three persons X Y Z, one of which always

lies".. etc.. (also vending machines)

33. There are 3 ants at 3 corners of a triangle, they randomly start moving

towards another corner.. what is the probability that they do not collide.

34. Write an efficient algorithm and C code to shuffle a pack of cards.. this   one was a
feedback process until we came up with one with no extra   storage.

36. Some more bitwise optimization at assembly level

37. Some general questions on Lex Yacc etc.

39. Given an array of characters. How would you reverse it?

   How would you reverse it without using indexing in the array

                        //do not understand the last part of the question

                        //not using indexes => pointer arithmetic??

40. Given a sequence of characters. How will you convert the lower

   case characters to upper case characters. (Try using bit vector

   -     sol given in the C lib -> typec.h) //anything other than

   -     //c = c - ('a' – 'A')??

41. RPC Fundamentals

42. Given a linked list, which is sorted. How will u insert in sorted

    way.

44. Tell me the courses you liked and why did you like them.

45. Give an instance in your life in which u were faced with a problem and you   tackled it
successfully. (oops!)

46. What is your ideal working environment. (They usually to hear that u can   work in group
also.)

47. Why do u think u are smart???

48. Questions on the projects listed on the Resume.

49. Do you want to know any thing about the company.(Try to ask some

    relevant and interesting question).

50. How long do u want to stay in USA and why?

51. What are your geographical preferences?

52. What are your expectations from the job.

53. Give a good data structure for having n queues (n not fixed) in a

   finite memory segment. You can have some data-structure separate for each   queue. Try to use at least 90% of the memory space.

54. Do a breadth first traversal of a tree. (print a tree level by level, each   level in a different line)

56. Write, efficient code for extracting unique elements from a sorted list of   array. e.g. (1, 1, 3, 3, 3, 5, 5, 5, 9, 9, 9, 9) -> (1, 3, 5, 9).

                    (Devise at least two different methods)

57. C++ (what is virtual function ?

   what happens if an error occurs in constructor or destructor.

   Discussion on error handling, templates, unique features of C++.

   What is different in C++, (compare with unix).

58. Given a list of numbers (fixed list) Now given any other list,

   how can you efficiently find out if there is any element in the

   second list that is an element of the first list (fixed list).

        //make an array out of it

60. If you are on a boat and you throw out a suitcase, will the level of

water increase?

62. write C code for deleting an element from a linked list (C++)

traversing a linked list

Efficient way of eliminating duplicates from an array

63. What are various problems unique to distributed databases?

64. declare a void pointer

a)   void   *ptr;

65. make the pointer aligned to a 4 byte boundary in a efficient manner

a)   Assign the pointer to a long number

and the number with 11...1100

add 4 to the number

66. what is a far pointer (in DOS)

67. what is a balanced tree?

68. given a linked list with the following property

node2 is left child of node1, if node2 < node1

els, it is the right child.

```
O P

|

|

O A

|

|

O B

|

|

O C
```

How do you convert the above linked list to the

form without disturbing the property. Write C code

for that.

```
        O P

        |

        |

        O B
      / \
     /   \
    /     \
  O ?   O ?
```

determine where do A and C go

69. Describe the file system layout in the UNIX OS

  a) describe boot block, super block, inodes and data layout

70. In UNIX, are the files allocated contiguous blocks of data

  a)   no, they might be fragmented

  how is the fragmented data kept track of

  a)   describe the direct blocks and indirect blocks in UNIX

      file system

71. Write an efficient C code for 'tr' program. 'tr' has two command

  line arguments. They both are strings of same length. tr reads an

  input file, replaces each character in the first string with the

  corresponding character in the second string. eg. 'tr abc xyz'

  replaces all 'a's by 'x's, 'b's by 'y's and so on.

  a)   have an array of length 26.

      put 'x' in array element corr to 'a'

      put 'y' in array element corr to 'b'

      put 'z' in array element corr to 'c'

      put 'd' in array element corr to 'd'

      put 'e' in array element corr to 'e'

and so on.

the code

```
while (!eof)
{
        c = getc();
        putc(array[c - 'a']);
}
```

72. what is disk interleaving?

73. why is disk interleaving adopted?

74. given a new disk, how do you determine which interleaving is the best

   a)   give 1000 read operations with each kind of interleaving

        determine the best interleaving from the statistics

75. draw the graph with performace on one axis and 'n' on another, where

   'n' in the 'n' in n-way disk interleaving. (a tricky question, should

   be answered carefully)

76. I was shown a c++ code and was asked to find out the bug in that. The bug

   was that he declared an object locally in a function and tried to

return the pointer to that object. Since the object is local to the

function, it no more exists after returning from the function. The

pointer, therefore, is invalid outside.

77. A real life problem - A square picture is cut into 16 squares and

they are shuffled. Write a program to rearrange the 16 squares to

get the original big square. (backtracking)

78. What is the difference between an Ethernet and an ATM?

13. A character set has 1 and 2 byte characters. One byte characters

have 0 as the first bit. You just keep accumulating the characters

in a buffer. Suppose at some point the user types a backspace, how can

you remove the character efficiently. (Note: You cant store the last

character typed because the user can type in arbitrarily many backspaces)

14. How would you reverse the bits of a number with log N arithmetic

operations, where N is the number of bits in the integer (eg 32,64..)

15. What is the simple way to check if the sum of two unsigned integers have   resulted in an
overflow. (why does the algorithm only works for unsigned

numbers?)

Solution:

2. Induction on i:1..n: Maintain the subarray with largest sum and

   suffix with largest sum and then update both after adding the

   i+1th element.

3. Sum of the numbers or copy i into A[i] so on till conflict.

4. Update deltaY while incrementing x. Have to multiply so that the

   deltay is not a floating pt number.

5. Find the largest 10**n less than given number, then div etc.

6. (a-1) xor a == 0 => a is a power of 2.

8. Infinite.

10. Shivku said this question is garbled thru ages.

11. reverse the pointers till you reach the end and print-and-reverse as you   return.

12. Have two 'threads' one at twice the speed of the other traversing the list and see if at anytime
they meet.

13. Scan the bytes backward till you reach one with the first bit

   set to 0. Now this is either a one byte character or the second

byte of a two byte one. Either way it marks a Character boundary.

Start from there and scan forward to find what the last character is.

14. Flip adjacent bits, then flip adjacent 2 bit sets, then 4-bits

and so on. Each of this swap can be done in constant time using

appropriate masks and shifts.

15. if (a+b) < a or (a+b) < b then overflow has occurred

---

1. Write a function to check if two rectangles defined as below overlap or not.

```
struct rect {

        int top, bot, left, right;

} r1, r2;  //
```

2. Write a program to print the elements of a very long linked list in   ascending order. There may be duplicates in the list. You cannot modify   the list or create another one. Memory is tight, speed is not a problem.

//ASK questions like what kind of list, and if templates can be used. If   //the ascending relationship is defined, etc.

3. Write a function to reverse a singly linked list, given number of links to reverse. (means, the other part will get lost) or we could save the list

append it to the end of the list, i.e. the old head of the original list)

4. Write a function to convert an int to a string.

(itoa, atoi, etc.)

5. Some weird problem on vector calculus with some transformation matrices

being applied - need paper and pencil to describe it.

6. Given ships travel between points A and B, one every hour leaving from

both ends (simultaneously), how many ships are required (minimum), if the

journey takes 1hr 40 mts. How many ships does each ship encounter in its

journey, and at what times?

Ans 4, 3 at 20 mts, 50 mts and 80 mts.

7. Write a SetPixel (x, y) function, given a pointer to the bitmap. Each pixel is represented by 1 bit. There are 640 pixels per row. In each byte,

while the bits are numbered right to left, pixels are numbered left to right.

Avoid multiplications and divisions to improve performance.

8. How do you represent an n-ary tree? Write a program to print the nodes

 of such a tree in breadth first order. (and use a queue), not efficient

Ans. Sibling and firstchild ptr

1. Consider the base -2 representation of numbers. (-2 instead of usual +2).

 Give the condition for a number represented in this form to be positive?

 Also, if P(A, B) is a function that takes two 0-1 strings A,B in this

 representation, when can we say that P(A,B) returns the sum of these two

numbers?   … if the position of the most significant set bit is odd, the   number is negative, otherwise, the number is positive. How do u find out   the most significant (i.e. left most) signed bit

2. Given a maze with cheese at one place and a mouse at some entrance, write

   a program to direct the mouse to cheese correctly. (Assume there is a path).

   Following primitives are given: moveforward, turnright, turnleft, iswall?,   ischeese?, eatcheese.

3. Given an expression tree with no parentheses in it, write the program

   to give equivalent infix expression with parentheses inserted where necessary. (inorder traversal, the main problem is the traversal, not parenthesizing it)

1. A byte has only one of its bits set. Write the code to find out which bit is

   set.

2. You have a long tape which contains numbers from 1 to a 1000 randomly

   arranged except for one number which is repeated, your task is to determine

   which number it is. The condition is the algorithm you choose should be

   implementable in linear time and space.

3. How do u detect a loop in a linked list? (devise at least two ways)

4. You have a singly linked list (no prev pointer). Your current pointer   pointing to a node x. Write code to delete x. You can have as many temp   pointers as you need.

1. Given two sorted linked lists write code to merge them (so that the final list is sorted?).

4. Given an integer use only putchar to print each num of the int out on the

   screen (in order). eg: Given an int 247, print: 2, 4, 7.

5. Write a class for a linked list. Give all the member functions that u would

   like a linked list to have, i.e., scan, insert, delete, etc.

6. A pic has a bitmap assoc w/ it and a 256 long array of original palettes.

   Now we have a change list, where some old colors are mapped onto new

   colors. Write the code to change the original palette. Now if the original

   bitmap has to be changed, write the code that will scan the pic as well as

   the changed palette array. The code shud be O(N) and not O(N^2). The struct

   of the original palette may b changed to accomplish this.

7. If a pic is getting built in one window and a dialog box pops up on top

   of it and then disappears. How d'u refresh the pic?

8. If x = a and y = b, how to swap the two var values w/o using a tmp var?

   Ans: x = a-(x-y)   and   y = b+(x-y)

1. Write a class for binary trees.

2. Asked to examine a piece of code and figure out the bug. The trick was to   know operator precedence; in particular, the ? operator.

3. SQL queries

4. Networks question: binding to a UDP socket, info about BSD sockets, etc.

5. Why manholes are round? Because they are round.

1. U r given an array. Reverse the array

   Describe ur algorithm based on memory and speed.

2. U r given an array which is supposed to contain numbers from 0 to N.

   Assume that two of the numbers are corrupted and become zero.

   How will u find these 2 numbers? [O(n) solution needed]

          Keep two variables – sum and product, compare with series and factorial of the entire array

3. Tell me about the most interesting projects u have done.