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# 

# Amazon (2017)

### Water collected between towers

<https://www.youtube.com/watch?v=pq7Xon_VXeU>

solve this problem yourself first --- try

then, see solution

### Design Blackjack game - OOAD

### Design Alexa commands interpreter

*i.e. how will your program identify what to do from user sentences*

Hint: break sentence into Action, and Action Meta Data

If the action meta data points to content like music or video - then, Content Type, Content Identifiers, Content Scope etc.

### Given a singly linked list where each node has two pointers - clone it

*where one pointer is for next node and one is for another random node in same list (could be to self as well) - Implement a function that returns a new copy of this singly linked list*

### Upgrading Amazon devices - server side scalability - high level arch/design

*Assume Amazon apps (like amazon shopping app, amazon prime video, etc) are running on several millions of devices - like iOS, Android device as well as Amazon fire devices like FireTV. How will you design a scalable solution that upgrades all these devices. Some of them may be offline for days and may come up later. They are all over the world*.

### High level arch/design

*Given a messaging app like FB messenger… assume a user sends a message from his iOS device to his friend on Android device. How does the messaging server side know to route it to correct device. Develop high level arch./design for app-to-server communication and server-to-route-to-correct-device.*

Apart from providing high level APIs and communication models, I address how messages are delivered with operation aspects of system arch for locating device by iCloud or Google cloud servers etc.

### Mastermind game

*Implement mastermind game*

https://rosettacode.org/wiki/Mastermind

### Number of Islands

*Given a satellite picture of earth as a large 2D matrix (millions of rows x millions of columns) where each cell has a numeric value representing that location's depth/height from sea level. E.g. 0 means water at sea level, 1 means land at 1 mt high, 100 means land at 100 mt high, -5000 means water with 5000 mt depth. Find number of islands on earth in that matrix.*

Time: 20 min,

First 10 min: I tried with crude way of nested for loops.

Then, next 10 min: I refined it to use DFS on a graph with each node having 8 child nodes representing 8 surrounding cells.

I could not finish problem because time was fixed => though I could implement 80% of code.

Right solution is using Union Find: <https://www.programcreek.com/2014/04/leetcode-number-of-islands-java/>

### Tracking promotions in the cart in Amazon Fresh Grocery Store.

*While a customer is shopping, apply/remove promotions as the contents change. Some promotions match only if the items are picked in a specific order. Input is two 2D arrays. First 2D array has each row with a list of items to match for a promotion. Second 2D array has promotion discount. Also, if the list of items has "any" for generic item or any item***.** *(HackerRank screening)*

Time: 45 min

Passed: 50/52 test cases

### 20% of interview overall had behavioral, situational questions

# 

# Apple (2019)

### Design a system like Zookeeper

(time: 10-15min)

### Implement a RangeTracker that will satisfy below API

*void addRange(int min, int max);*

*boolean queryRange(int min, int max);*

*boolean deleteRange(int min, int max);*

*void listRanges(); // in-order print*

(time: 90 min)

Gave me a Mac and asked me to solve there while interviewer worked... solved 46/47 test cases.

### Given a number n, create max 2D square matrix to fit 1..n, transpose, print

*e.g. if 12 is given, maximum square matrix possible to fit 1..12 is a 3x3 matrix i.e. we fit from 1..9 in those cells.*

*It is not 4x4 matrix because then few cells will be empty. Our problem should take input n, then create that matrix in memory, rotate it by 90 degrees i.e. transpose it and print*

Time: 15 min

Design a polygon class hierarchy that can be used to create draw any polygon shape

Time: 10 min

### High level arch./design

*When multiple iOS devices from same profile are connecting, and making either changes or taking actions on their profile e.g. changing passcode on a specific device or changing that icloud account password or changing backup storage subscription size or adding a new payment method or buying a subscription service ... events could be coming to different servers as these devices could be in same family members but in different locations (e.g. home, office, school, or friend's house). These events must processed in sequence, no two events of same profile should be processed same time by two different servers. Also, all events must be processed, but sequentially. Note: your design must not solve problem only for one profile concurrency, sequencing - but also for scaling to handle all millions of requests for all users coming in same time.*

Time: 30 min - not fixed,

it started with a high level arch/design, then specific scenarios were discussed, design/arch fixed,

some of my design aspects involved certain db capabilities... there were asked to be addressed to use low cost object databases instead of assuming oracle style high cost scalable relational db

also, some of design aspects needed to be broken down further into small pieces are modified aspects not become central bottlenecks etc

### Design a batch processing system

*You have a large data processing requirement that needs to be done daily night as batch processing. How will you design system?*

Time: 10 min,

I followed SpringBoot Batch pattern of chunking, reader, process, writer pattern to address buffering, scaling, performance, throttling aspects of batch processing system.

### 20% of interview overall had behavioral, situational questions

# eBay (2017)

### How do you design logging ecosystem?

*Should be for cloud based, distributed services based ecosystem*

*Will it be centralized, how to do you collect and search logs*

*How do you tie distributed logs for a transaction end to end*

### Implement reversing a doubly linked list

### Implement finding whether a linked list is circular

### Search for a data and delete that node in a single linked list

### Given an excel sheet with column headers like A,B,…,Y,Z,AA,AB,... Generate an array that will map these into column numbers like 1,2,...,25,26,27,28,...

### Design a restaurant ordering system (data representation + server OOAD)

### Why composition over inheritance - give examples from projects you did

### What is functional programming - where did you use it

### Differences between functional programming and object programming

### DB schema design

*For an eCommerce system - items, orders, cart, different vendors for single order with multiple items etc. DB partitioning, sharding etc for historical data for 3 years, geo-location based etc.*

### 30% of interview overall had behavioral, situational questions

# 

# FaceBook (2018)

### Add very large numbers

*(a) write a function to add two very very large binary numbers that are passed to your function as strings. You should return string.*

*(b) generalize it to work for binary, decimal or octal system. Does not have to work for duo-decimal or hexa-decimal i.e. greater than decimal system is not needed.*

Time: 15-20min

Hint: writing generalized directly is better

### Convert number to words

*Write a function that takes a number and prints in words e.g. 1244 => one thousand forty four. It should correctly handle negative numbers, millions, thousands, billions, trillions etc. It should also handle fractions i.e. 1.23 => one and twenty three parts in hundred, 113.3356 => one hundred thirteen and three thousand fifty six parts in ten thousand. Note: use 'and' to separate whole part from fraction part.*

Time: 15-20min

Hint: I wrote a function that handles a 3 digit number as a unit.

Then, used that function in a controller function to tackle the number at large.

I even refined it to use recursion ( though that's not needed ).

### Find the shortest part between 2 nodes in a tree

Time: 15-20min

### Print paths to all edges (from root to edge) in a tree

Time: 15-20min

### Find the shortest part between 2 nodes in a tree

Time: 15-20min

# 

# Google (2018)

### Search, coding, HashMap

*Given a string, a font size range (min to max) and a screen with certain width and height - return what's the max font size for which that string fits in screen. It is not a fixed width font i.e. every char has its own width. Height is same for all chars.*

*You can assume there are two functions for your use:*

*int getWidth(char ch, int fontSize) - returns width of that char in number of pixels*

*int getHeight(int fontSize) - returns height of that font size in number of pixels*

*Here's the signature of the function to write:*

*int findMaxFontSizeThatFits(String str, int minFontSize, int maxFontSize, int screenWidthInPixels, int screenHeightInPixels)*

*You can assume that a word can break in between when wrapping, but not a char.*

*Write compilable code.*

Hint:

binary search, actual implementation to fit text, and HashMap

I modified above signature to include one more param, int maxSizeSoFar

I used recursion in this because min/max keeps changing for binary search

### HashMap style thinking

*You're given a series of numbers 1..n, but in an array of (n+1) size i.e. one of the numbers is duplicated. You've to return the duplicated number.*

I gave solution (a) below,

function getDuplicate(list) {

var found = [];

for (var i = 0; i < list.length; i++) {

var num = list[i];

if ( found[num] ) {

return num;

}

else {

found [ num ] = true;

}

}

return null; // will happen only is there are no duplicates

}

Above solution has,

time complexity: O(n) = n for worst case, O(n) = 1 for best case, O(n) = n/2 for average case

space complexity is O(n) = 2n for worst case, O(n) = 2 for best case, O(n) = 2 for average case

*Modify it such that, time complexity does not change -*

*but space complexity is half of what it is in above solution*

*Allowed to modify 1st array itself to find duplicate*

Clue:

- do not use 2nd array

- ask if all numbers are positive then make them negative as you visit first time and if duplicate exists, you will visit a negative number i.e. being non-positive indicates duplicate

### Converting to negative binary system

*(a) Write a function to convert a decimal number to binary system*

*(b) now, write a function to convert a decimal to negative binary system*

*negative binary system has base (-2) and allowed digits are 0, -1*

*(not 0, 1)*

Pretty easy like regular binary conversion, but you've to be careful when remainder is 1 instead of -1

### Design question # 1

*(a) How will you implement a function that generates unique request id across all requests across all servers.*

*(b) If the server on which user request/session exists goes down, user shouldn't know it - how will you design it*

*(c) if the user is travelling and crosses from US to UK, still use shouldn't know it*

(time: 30 min)

### Design question # 2

*If you are working on a project that's sending rovers to moon and they're revolving around moon - many of them...*

*if you've to upgrade software every week on each of them, how do you do*

*remember, remote call to moon is expensive*

*if any upgrade link breaks in middle, rover becomes unusable and that's expensive*

*how will you design it*

(time: 10min)

### Water Collected Between Towers

### Design question # 3

*How do you design a document storage and retrieval system that can be used by Google docs, Gmail and any other doc sharing system by Google Cloud customers while enforcing security, ACLs, fast access across globe, localization, caching, scalability.*

Answering this question took ~40 min because lot of discussion, back and forth Q&A, refining, cutting down scope of solution in some aspects, adding more complexity at some places etc etc.

# 

# Salesforce (2019)

### Cache

*a) Implement (complete coding) an LRU*

(time: 15-20 min) => solution doubly linked list and Hashmap

*b) improvise it to use counts of number of times access - MRU*

(time: 15-20 min) => balanced binary tree

*c) 5min more - can you think and suggest how to do distributed cache like Redis*

### Dependency System

*Create a system dependency that will automatically install dependencies when a software is installed, delete dependencies when all dependent softwares are uninstalled, but should not implicitly delete if it is explicitly installed i.e. if it is explicitly installed, it must be explicitly uninstalled. Create test cases.*

Time: 2 hr. I did it in 100min.

(see dependency project)

### Find shortest path in a social network graph?

Time: 2 hr. I did it in 112min.

Hint: bidirectional BFS (see sixdegrees project)

### Function with a Sudoku problem 2D matrix as input and returns solution.

(time: 20 min)

I wrote in crude way using HashSets - one each for a row and one each for a column.

Then, I refined it with tree.

### 40% of interview overall had behavioral, situational questions