This guide is meant to be a supplement to all CS161 instruction and notes. Past students have found it particularly helpful to review online resources and videos to supplement understanding of the material to ingest the information through another medium. There’s a lot of good content out there, so the purpose of this document is to narrow that down to a few videos and websites for each lecture that are particularly useful. Happy learning!

1 Why are you here? And do you know how to multiply integers?

Karatsuba Explained: https://www.youtube.com/watch?v=fQ3VgyNR49A

2 MergeSort, Recurrences, and Asymptotics

Insertion Sort Refresher: https://www.geeksforgeeks.org/insertion-sort/
Merge Sort in 3 minutes: https://www.youtube.com/watch?v=4VqmGxwpLqc
Big O, Ω, Θ Explained: https://www.youtube.com/watch?v=0oDA1MwTrLo
Recurrence Relation Proof by Induction: https://www.youtube.com/watch?v=t_3ACuzEe_8
Running Time Proof by Induction: https://www.youtube.com/watch?v=XWykCejG1Rk

3 More recurrences, the master theorem, and the substitution method

Master Theorem: https://www.youtube.com/watch?v=T68vN1FY4o
Master Theorem Example: https://www.youtube.com/watch?v=mSX8jFgTCz0
Substitution Method step-by-step: https://www.youtube.com/watch?v=0bBShG0fz6p0

4 More substitution method and the selection problem

kth largest element Leetcode Example: https://www.youtube.com/watch?v=FrWq2rzPnPLQ
Walkthrough: https://www.geeksforgeeks.org/kth-smallestlargest-element-unsorted-array/

5 Randomized Algorithms and QuickSort

Quick Sort Refresher: https://www.geeksforgeeks.org/quick-sort/
Quick Sort Worst Case Analysis: https://www.youtube.com/watch?v=a1cmn641AI
Quick Sort Random Pivot: https://www.youtube.com/watch?v=X4Mcd25VYFk
Quick Sort Time Complexity: https://www.youtube.com/watch?v=aMbSGH0PQ1U
Quick Sort Python Example: https://leetcode.com/problems/k-closest-points-to-origin/discuss/219442/
Python-with-quicksort-algorithm
6 BucketSort, RadixSort, and Sorting Lower Bounds

Bucket Sort Refresher: https://www.youtube.com/watch?v=VuXbEb5ywrU
Radix Sort Refresher: https://www.youtube.com/watch?v=nu4gDuFabIM
Radix Sort Explained: https://www.youtube.com/watch?v=XiuSW_mEn7g

7 Binary Search Trees and Red-Black Trees

BST Demo: https://www.youtube.com/watch?v=mtvbVLK5xDQ
Red-Black Tree Basics: https://www.youtube.com/watch?v=qvZGUFWChY
Red-Black Tree Rules: https://www.youtube.com/watch?v=nHEzd4DthdA
Red-Black Tree Rotation: https://www.youtube.com/watch?v=95s3mdZRGbk
Red-Black Tree Insertion: https://www.youtube.com/watch?v=5Ibxa-bZZH8
Red-Black Tree Insertion Example: https://www.youtube.com/watch?v=A3JZinZkMpk

8 Hashing!

Hash Table Basics: https://www.youtube.com/watch?v=shs0KM3wKv8
Hash Functions in 2 minutes: https://www.youtube.com/watch?v=2B1dE6GZKB8
Universal Hashing: https://www.youtube.com/watch?v=3cTTzYc3gnE
Universal Hash Families: https://www.youtube.com/watch?v=GKtg72W_Xcg
Balls and Bins: https://www.youtube.com/watch?v=bPtCBqdf9L4

9 Graphs, BFS and DFS

Adjacency List: https://www.youtube.com/watch?v=9C2cpQZVRLA
BFS vs DFS: https://www.youtube.com/watch?v=TIbUeeksXcI&t=25
Graph Search, BFS, DFS: https://www.youtube.com/watch?v=zaBhtODEL0w

10 Finding Strongly Connected Components

SCC Refresher: https://www.geeksforgeeks.org/strongly-connected-components/

11 Dijkstra’s Algorithm and Bellman-Ford

Dijkstra’s Shortest Path: https://www.youtube.com/watch?v=gdmfOwyQ1cI
Dijkstra’s Explained: https://www.youtube.com/watch?v=pVfj6xhdMw
Dijkstra’s Example in 3 minutes: https://www.youtube.com/watch?v=_1HSawgdXpl
Dijkstra’s vs Bellman-Ford: https://www.youtube.com/watch?v=EQ_1i8nWhDx
Bellman-Ford: https://www.youtube.com/watch?v=9PHkkOuavTM
Bellman-Ford Example: https://www.youtube.com/watch?v=obWXjtg0L64
Bellman-Ford and negative cycles: https://www.youtube.com/watch?v=ly4FamxrhG

12 Dynamic Programming and shortest paths: Bellman-Ford and Floyd-Warshall

DP Explained: https://www.youtube.com/watch?v=Yquumk4nWw
DP Again: https://www.youtube.com/watch?v=P8Xa2BtN3I
Floyd-Warshall Simple: https://www.youtube.com/watch?v=4QteCuLYj-4
Floyd-Warshall: https://www.youtube.com/watch?v=yYquumk4nWw
13 More dynamic programming

DP Longest Common Subsequence: https://www.youtube.com/watch?v=ASoaQq66foQ
DP Longest Common Subsequence: https://www.youtube.com/watch?v=Qf5R-uYQRPy
DP 0-1 Knapsack: https://www.youtube.com/watch?v=x0lhR_2QCXY
DP 0-1 Knapsack: https://www.youtube.com/watch?v=xObyMUPvc2Q

14 Greedy Algorithms

Greedy Algorithm Intro: https://www.youtube.com/watch?v=3XaqEng_K5s
Activity selection problem: https://www.youtube.com/watch?v=7UbMn9D1KsA
Scheduling problem: https://www.youtube.com/watch?v=nUShpavQae8
Scheduling problem: https://www.youtube.com/watch?v=BUx1dP7Unk
Scheduling Runtime analysis: https://www.youtube.com/watch?v=277RLZmhTK4

15 Minimum Spanning Trees

Prim’s Algorithm: https://www.youtube.com/watch?v=cplfcGZmX7I
Kruskal’s Algorithm: https://www.youtube.com/watch?v=71UQHPr9kU
Kruskal’s Longer Explanation: https://www.youtube.com/watch?v=Yo7sddEV0Ng
Proof of Prim’s: https://www.youtube.com/watch?v=UfhUr5QzfiI

16 Minimum Cuts and Karger’s Algorithm

Karger’s Explained: https://www.youtube.com/watch?v=KqMGeNZuwfI
Karger’s refresher: https://www.youtube.com/watch?v=9sH4Rcpdu8
Karger’s example: https://www.youtube.com/watch?v=wmPuTX2Wlgs
Karger’s longer explanation: https://www.youtube.com/watch?v=GSeKBfYei0