

CPSC 335 — Lecture #4

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Timestamps

09/21/2020 - 07:27:25 PM

MIDTERM NEXT WEEK!

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1 Lecture

*Dedicated to @QuesoGrande a.k.a. Jared D.

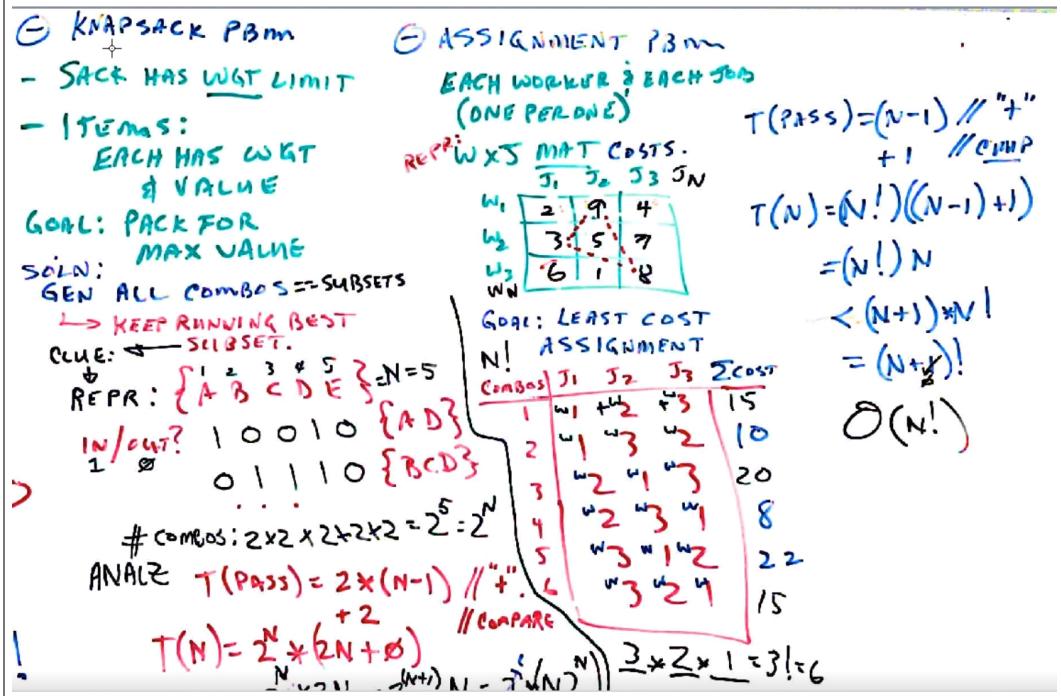


Figure 1: Knapsack Problem

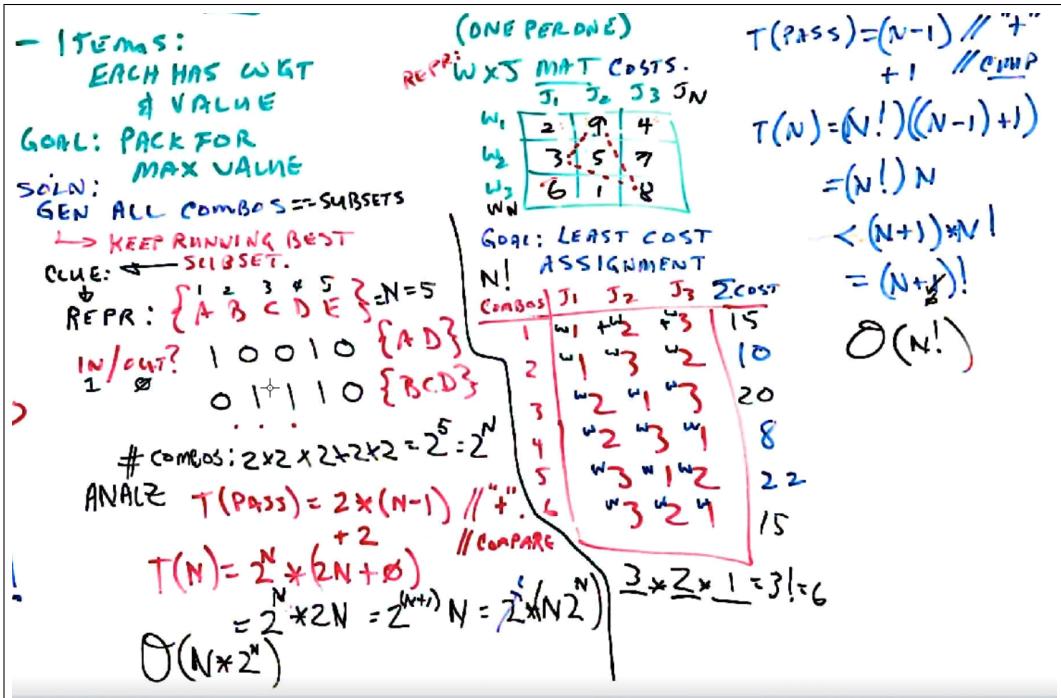


Figure 2: Knapsack Problem (cont.)

TEMPLATE

$$T(N) = A \times T\left(\frac{N}{B}\right) + \mathcal{O}(N^D)$$

1. WHAT IS A, B, D ?

CASE I: $A < B^D \Rightarrow \mathcal{O}(N^D)$

CASE II: $A = B^D \Rightarrow \mathcal{O}(N^D * \log N)$

CASE III: $A > B^D \Rightarrow \mathcal{O}(N^{\log_B(A)}) = \mathcal{O}(N^C)$

f(N)

$T(N) = B^C * T\left(\frac{N}{B}\right) + \mathcal{O}(N^D)$

I: $C < D \Rightarrow \mathcal{O}(N^D)$
II: $C = D \Rightarrow \mathcal{O}(N^D * \log N) = \mathcal{O}(N^C * \log N)$
III: $C > D \Rightarrow \mathcal{O}(N^C)$

PRINT BIN TREE:

$T(N) = 2 * T\left(\frac{N}{2}\right) + \mathcal{O}(1)$

$\begin{cases} A=2 \\ B=2 \\ D=0 \end{cases}$

$\begin{cases} A=2 \\ B=2 \\ D=0 \end{cases} \Rightarrow \log_2(2) = 1 = \mathcal{O}(N^1) = \mathcal{O}(N)$

Figure 3: $O(N^D)$

2 Review

$$EX: T(N) = 3 * T\left(\frac{N}{2}\right) + \Theta(N^2)$$

$$A=3, B=2, D=2$$

$$(A=3) < (B^D = 2^2 = 4)$$

$$\therefore \Theta(N^3) = \Theta(N^2)$$

TRIANGLE NUMBERS

(Hard way)

SQUARES

$$T(1) = 1$$

$$S(1) = 1$$

$$T(2) = 1+2 = 3$$

$$S(2) = 1+4 = 5$$

$$T(3) = 1+2+3 = 6$$

$$S(3) = 1+4+9 = 14$$

$$T(4) = 1+2+3+4 = 10$$

$$S(4) = T(4) + T(3)$$

$$T(5) = 1+2+3+4+5 = 15$$

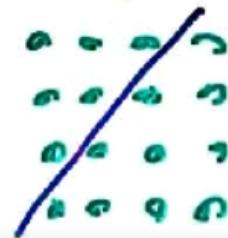


Figure 4: Triangle Numbers Problem

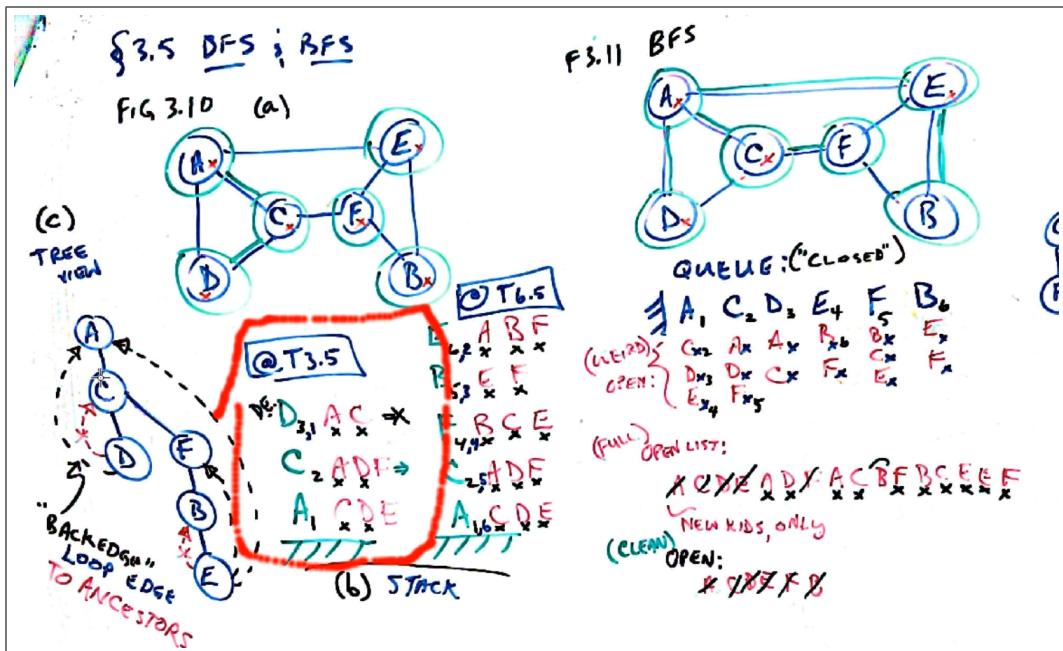


Figure 5: Depth First Search — Fig. 3.10

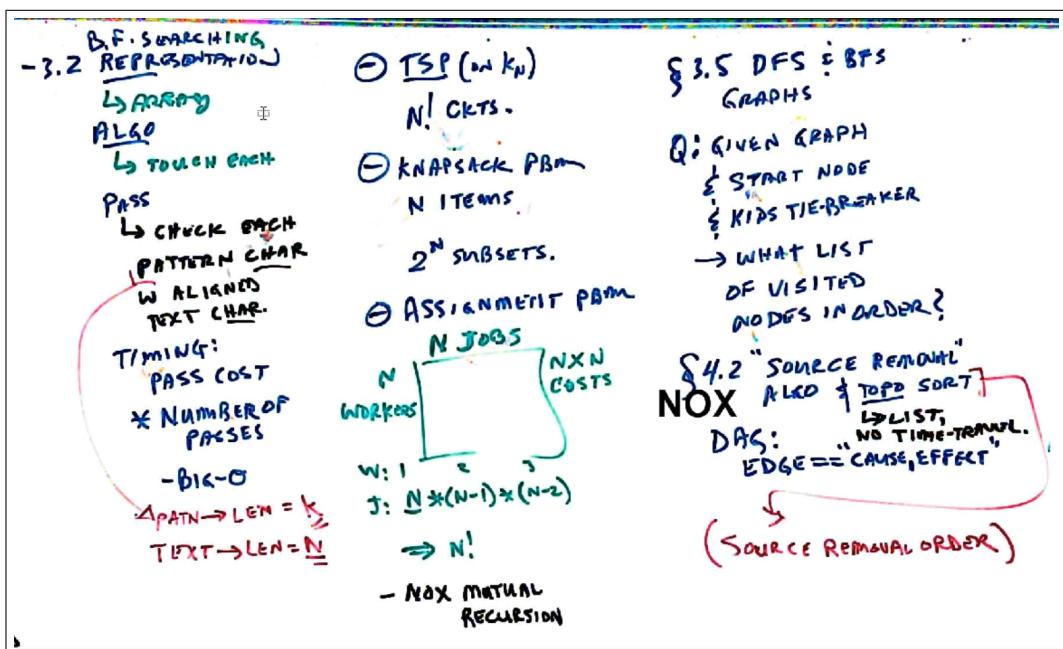


Figure 6: Breadth First Search

PRE-EXAM REVIEW
- EXERCISES ASSIGNED

Q: BIG-O CALC:
From $T(N)$

$$T(N) = 42N^2 + 5N \log(N) + 3N^2 + 2$$

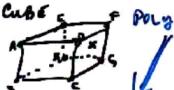
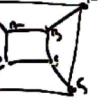
$$= 42N^2 + 5N^2$$

1. BIGGEST TERM
↳ ZERO SMALLER TERMS
TERM + TERM = TERM...

1a. REPLACE COS(\rightarrow) BY 1.
 \approx
↳ REPLACE "WEIRD" FACTOR BY "DOMINATOR"
IF YOU KNOW OF ONE.

2. REPLACE TERM'S CONSTANT FACTOR BY 1.

GROWTH "CLASSES."

$N \neq \log N$ $\begin{matrix} 1 & \\ \log N & \\ N & \\ N^2 & \\ N^3 & \\ \dots & \\ 2^N & \\ \dots & \\ N! & \end{matrix}$	<ul style="list-style-type: none"> - NOX MINI-SNG - TREEWALKING? - NOX 1.2 - 1.4 BRUTEFORCE - PBMM \rightarrow B.F. ALGO-ISM - OPS TO COUNT - $T(N) \rightarrow \text{BIG-O}$ - BRANCHING FACTOR - COMPONENT, CONNECTIVE - EDGE/LINK - NODE/MATRIX - LOOP/CYCLE 		POLYHEDRON 	AD: Ls
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2.

GRAPHS: TERMS

K INDs, ADJ MAT (FEATURES)

BIGGRAPH, DAG, COMPLETE, BIPARTITE, PLANAR, K_4 , $K_{3,2}$, PETERSEN (from k_7)

KÖNIGSEIGER BRIDGES PROB
EULER CKT. CROSS BRIDGE, once
HAMILTONIAN CKT. TOUCH NODES, once

ROTH EX. RING



Figure 7: Review Pt. 1