

# 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

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

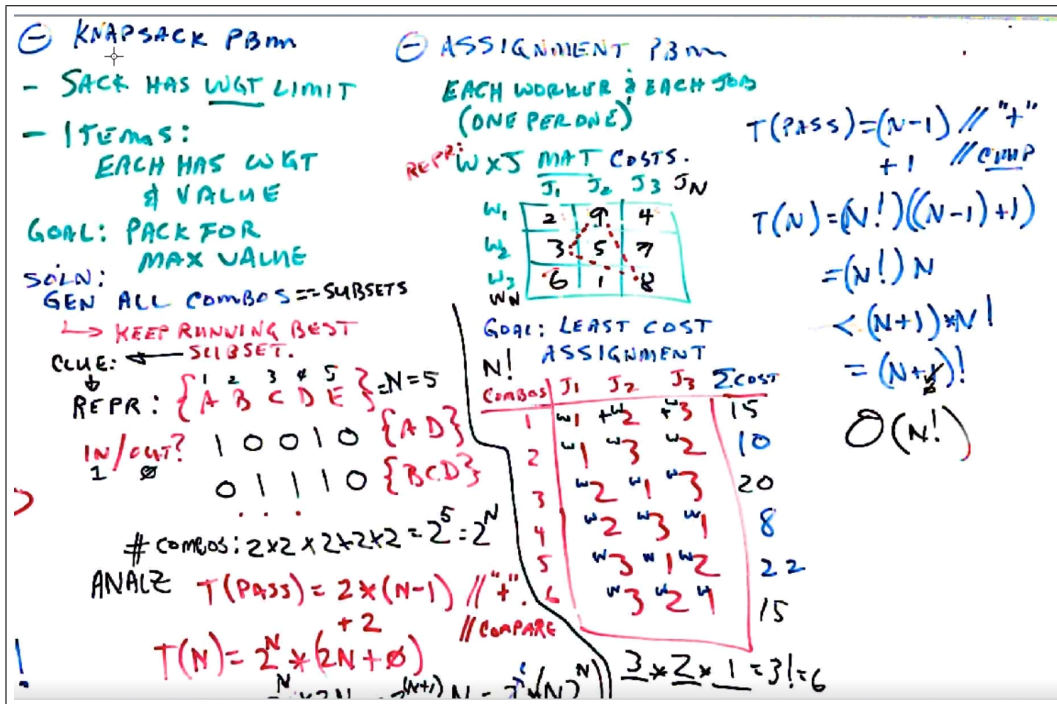


Figure 1: Knapsack Problem

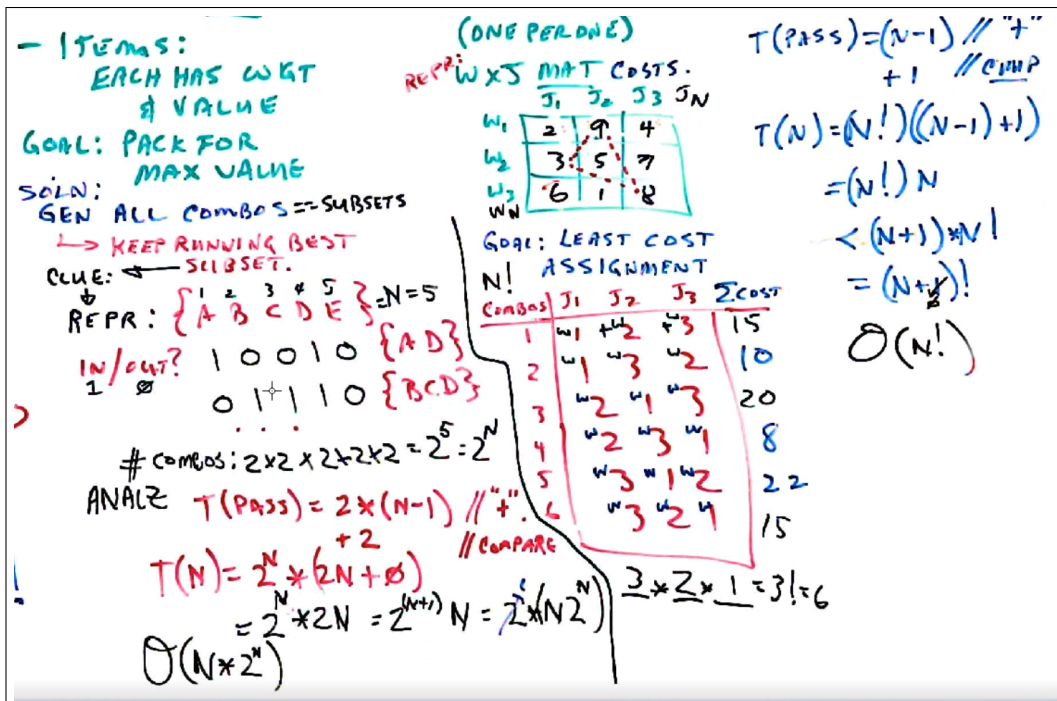


Figure 2: Knapsack Problem (cont.)

TEMPLATE  
 $T(N) = A * T(\frac{N}{B}) + O(N^D)$

1. WHAT IS A, B, & D?

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

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

PRINT BIN TREE:  
 $T(N) = 2 * T(\frac{N}{2}) + O(1)$   
 $A=2, B=2, D=0$   
 $(A=2) > (B=2)^{D=0}$   
 $2 > 1 \Rightarrow III$   
 $C = \log_2(A) = 1$   
 $O(N^2)$   
 $= O(N)$

$A = B^C$   
 $A = B$   
 $C = \log_B(A)$

Figure 3:  $O(N^D)$

## 2 Review

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

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

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

I:  $O(N^D) = O(N^2)$

TRIANGLE NUMBERS  
(HARD WAY)

SQUARES

$T(1) = \bullet$

$S(1) = 1$

$T(2) = \bullet \bullet = 3$

$S(2) = \begin{matrix} \bullet & \bullet \\ \bullet & \bullet \end{matrix}$

$T(3) = \begin{matrix} \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \end{matrix} = 6$

$S(3) = \begin{matrix} \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \end{matrix}$

$T(4) = \begin{matrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{matrix} = 10$

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

$T(5) = \begin{matrix} \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet \end{matrix} = 15$

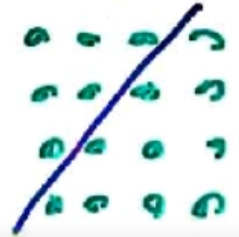


Figure 4: Triangle Numbers Problem

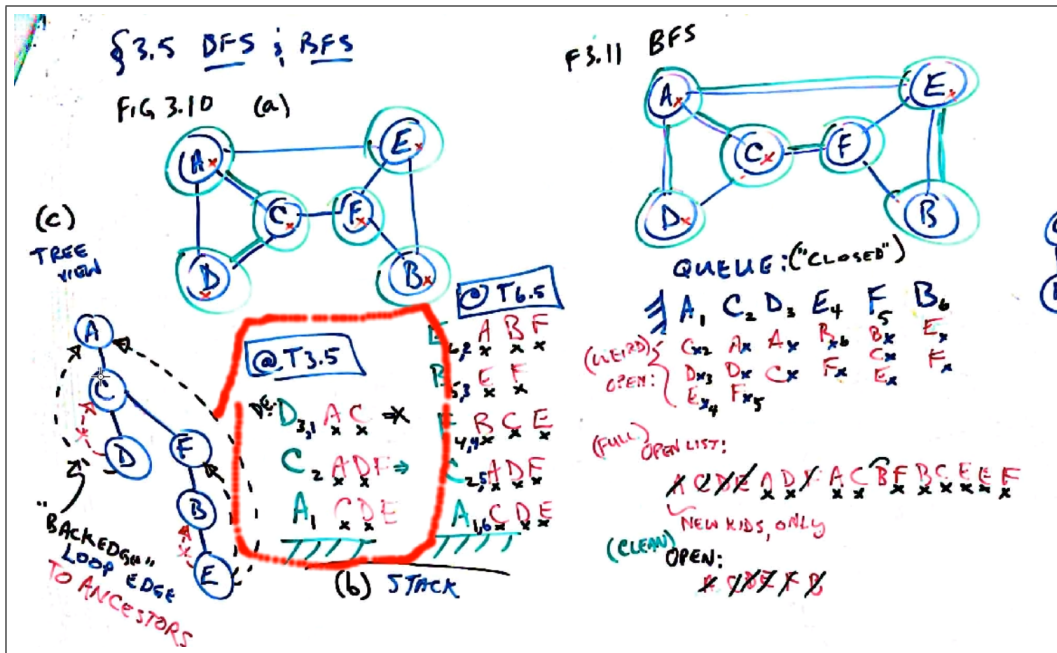


Figure 5: Depth First Search — Fig. 3.10

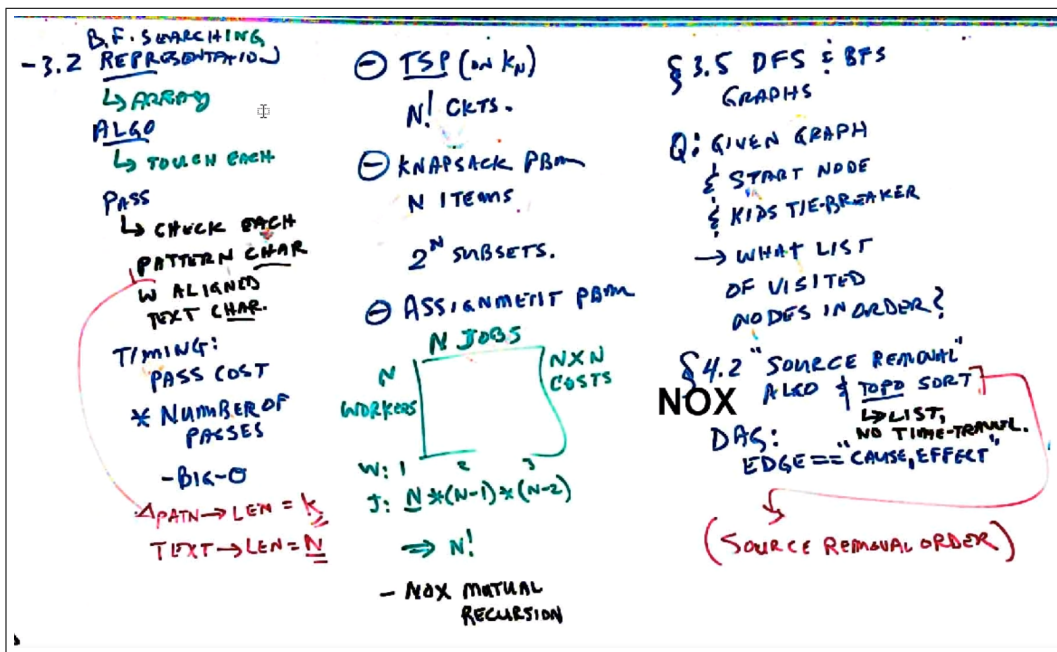


Figure 6: Breadth First Search

PRE-EXAM REVIEW  
- EXERCISES ASSIGNED

Q: BIG-O CALC:  
FROM T(N)

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

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

1A. REPLACE COS(→) BY 1.  
 " SIN(→) BY 1.  
 ↳ REPLACE "WEIRD"  
 FACTOR BY "DOMINATOR"  
 IF YOU KNOW OF ONE.

2. REPLACE TERM'S CONSTANT  
 FACTOR BY 1.

- GROWTH "CLASSES."

1  
 $\log N$   
 $N$   
 $N \log N$   
 $N^2$   
 $N^3$   
 $2^N$   
 $N!$

- NOX MINI-SUBG  
 - TREE WALKING?  
 - NOX 1.2  
 - 1.4 BRUTE FORCE  
 PBM → B.F. ALSO ISM  
 ↳ OPS TO COUNT  
 ↳ T(N) → BIG-O

- GRAPHS: TERMS  
 ↳ BRANCHING FACTOR  
 ↳ CONSTANT, CONNECTED  
 ↳ EDGE/LINK  
 ↳ NON-ALGEBRA  
 ↳ LOOP/CYCLE

KINDS, ADJ MAT (FEATURES)  
 ↳ DIGRAPH, DAG, COMPLETE,  
 ↳ BIPARTITE, PLANAR,  
 $K_4, K_{3,2}$ , PETERSEN  
 (FROM  $K_5$ )

CUBE  
 POLYHEDRON  
 PLANAR

KÖNIGSBERG BRIDGES PBM  
 - EULER CKT CROSS MOVES ONCE  
 - HAMILTONIAN CKT  
 TOUCH MOVES ONCE  
 BOTH EX: RING

AD: L6  
 -2.  
 -  
 -  
 -  
 -  
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Figure 7: Review Pt. 1