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# SHEET #01

## Introduction to computer Science.

Wednesday.

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## Problem 1.1

→ $E = \{\ \}$
$A = \{\{a\},\{b\},\{c\},\{d\},\{e\},\{f\}\}$
$C = 0$

→ $E = \{\{e,f\}\}$
$A = \{\{a\},\{b\},\{c\},\{d\}\ \{e,f\}\}$
$C = 1$

→ $E = \{\{e,f\},\{d,f\}\}$
$A = \{\{a\},\{b\},\{c\},\{d,e,f\}\}$
$C = 1+2 = 3$

→ $E = \{\{e,f\},\{d,f\},\{c,f\}\}.$
$A = \{\{a\},\{b\},\{c,d,e,f\}\}$
$C = 1+2+4 = 7$

→ $E = \{\{e,f\},\{d,f\},\{c,f\},\{b,f\}\}$
$A = \{\{a\},\{b,c,d,e,f\}\}$
$C = 1+2+4+6 = 13$

Minimal Spanning Tree.

→ $E = \{\{e,f\},\{d,f\},\{c,f\},\{a,f\}\}.$
$A = \{a,b,c,d,e,f\}$
$C = 1+2+4+6+8 = \underline{\underline{21}}$ Total Minimum Cost

```
t = FFLFLFRFRFFLFRF  p = FFLFR

F F L F L F R F R F F L F R F
F F L F R
  F F l f r
    F f l f r
      F F l f r
        F f l f r
          F F l f r
            F f l f r
              F F l f r
                F f l f r
                  F F L F R

alignments used: 10   comparisons made: 22
```

b.

t = FFLFLFRFRFFLFRF  p = FFLFR

```
F F L F L F R F R F F L F R F     skip
f f l f R                          1
    F F L F R                      0
      f f l f R                    0
            f f l f R              2
              f f L F R            1
                  F F L F R
```

alignments used: 6   comparisons made: 16

c. lookup table

| | F | F | L | F | R |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| F | - | - | 0 | - | 0 |
| L | 0 | 1 | - | 0 | 1 |
| R | 0 | 1 | 2 | 3 | - |
| P | 0 | 1 | 2 | 3 | 4 |

## Problem 1.3

a) $\rightarrow f_8(n) = \log \log n$

$\rightarrow f_6(n) = 2 \log n$

$\rightarrow f_1(n) = \frac{1}{2} n \log n$

$\rightarrow f_3(n) = \sqrt{n^3}$

$\rightarrow f_2(n) = n^2$

$\rightarrow f_5(n) = 100n^2 + 10n^3$

$\rightarrow f_7(n) = (n^2)^2$

$\rightarrow f_4(n) = n^n$

b) $f$ is $O(g)$, $g$ is $O(h)$ $\rightarrow$ $f$ is $O(h)$

PF:

- $f(n) \leq c\, g(n) \mid c > 0 \quad n \geq 0 \quad \forall n \geq n_0$
- $g(n) \leq c'\, h(n) \mid c' > 0 \quad n \geq 0 \quad \forall n \geq n_0$

~~if~~ it follows

$$f(n) \leq c\, g(n) \leq cc'\, h(n)$$
$$f(n) \leq cc'\, h(n) \quad \forall n \geq \max(n_0, n_0')$$