Lecture 6 03.1.23

Test #1 Mar 8th

Test #2 Apr 12th

Test #3 Apr 26th

Test 1 #1 Mar 8 Next Week

1. Check Announcements for Room
2. will have a sign on our regular room Door if we switch Rooms.
3. Section 400 (Distance) let me know if you are coming to take the test with on-campus students by Sunday.
4. Calculator TI-30Xa

Asymptotic Notation

Bound functions O Ω Θ o ω

Comparing Bounds

Predict running times.

Best case Average case worst case Relationship.

Problem / Algorithms / Implementations. Relationship.

Problem Comparison

Sets Relations Handout.

Graph theory

special graphs, complete, bipartite graphs, Trees. coloring, smallest last vertex ordering.

Isomorphic

Graph Algorithms: Prim MST (Minimum spanning tree)

Kruskal MST

Dijkstra Single Source Shortest Path.

Euler Tours

Hamiltonian cycles

Ford Fulkerson Max Flow

Multi Source / sink

Maximal matching

I would ask a question about Hamiltonian cycles, like which values of the new complete graphs, which z vertices have a Hamiltonian cycle?

Compression

Huffman coding

Entropy

Tree serialization

Number Theory

Powers of 2

modular arithmetic

+ negation exponentiation reciprocal

casting out 9s

Discrete Log Problem

Diffie Hellman key Exchange

Fermat's little Theorem $a^p \% p \equiv a$ $a^{p-1} \% p \equiv 1$

$\phi(n)$

$\phi(p) = p-1$ $\phi(p \cdot q) (p-1)(q-1)$

The idea behind casting out nine was:

If I give you a number 9 6 4 8 7 3 4 2 2 $\%9 = 1$

$+$ 3 1 1 5 9 2 8 3 4 $\%9 = 1$

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1 2 7 5 7 8 0 1 5 5 6 $\%9 = 2$

3 1 7

$3+1+7 = 11$ $\%9 = 2$

reciprocal

The question is, we want to do division

$\frac{1}{3}\%7$

$(3 \times \_)\%7 = 1$

$(3 \times 5)\%7 = 1$

$\frac{1}{3}\%7 = 5$

$\frac{1}{2}\%7 = 4$ because $(2 \cdot 4)\%7 = 1$

$\frac{2}{3}\%7 = 10\%7 = 3$

$(3 \times \_)\%7 = 2$

$(\frac{2}{3} + \frac{1}{2})\%7$

$\frac{1}{3}\%7 = 5$

$\frac{1}{2}\%7 = 4$

$(2 \times 5 + 4) = 14\%7 = 0$

$-\frac{1}{3}\%7$

$-5\%7=2$

$(7-5)\%7=2$

$6\frac{2}{8}\%7$

$-\frac{1}{3}\%7=(7-\frac{1}{3})\%7$

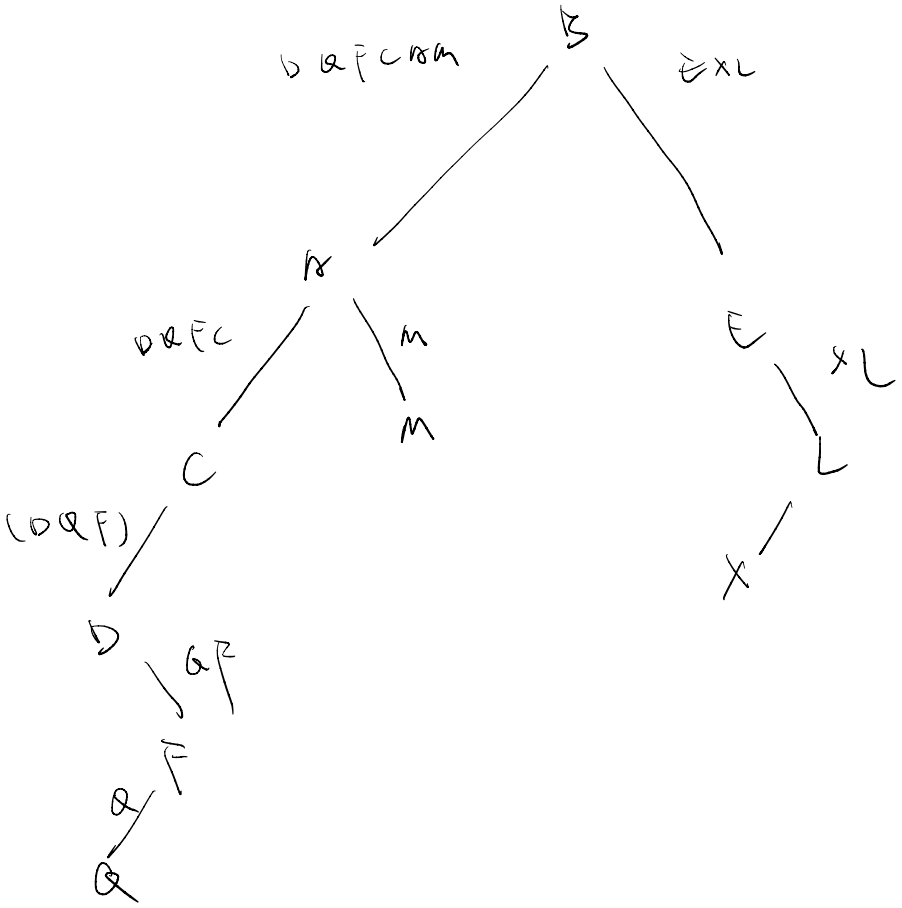
$-\frac{1}{3}\%7=(-\frac{1}{3}+7)\%7=(-3+7)\%7=2$

$(-\frac{1}{8}+7)\%7=6\frac{2}{8}\%7$

$6+(5+5)=16\%7=2$

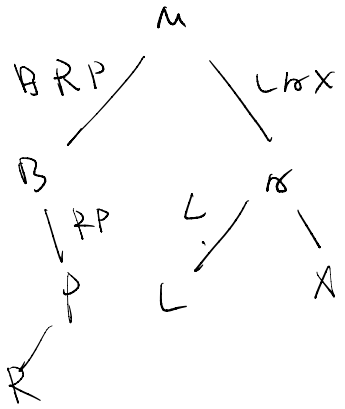
In

Pre



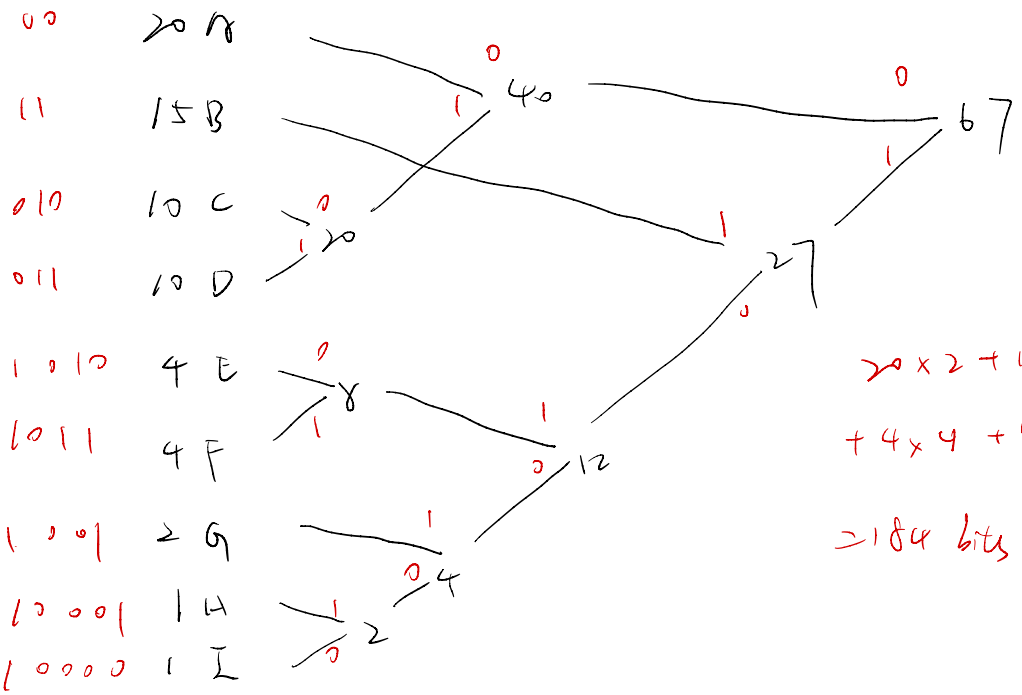
In order (B R P) M (L R X)

Post (R P B) L X R M



Let say that I have a message

keep combing 2 small.



$20\times2+15\times2+3\times10+3\times10$

$+4\times4+4\times4+2\times4+1\times5+1\times5$

$=184$ bits

Huffman code message

how much actual information it contains?

R: $\log_2\frac{67}{20}=1.744$ $\times 20$

B: 2.159 $\times 15$

C: 2.744 $\times 10$

D: 2.744 $\times 10$

E : 4.066 ×4

F = 4.066 ×4

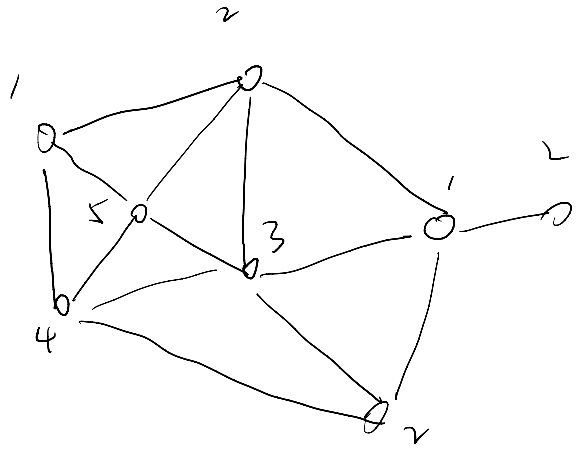
G = 5.066 ×2

H = 6.066 ×1

I = 6.066 ×1

176.937

coloring



A	2 base	B
4	11 modules	8

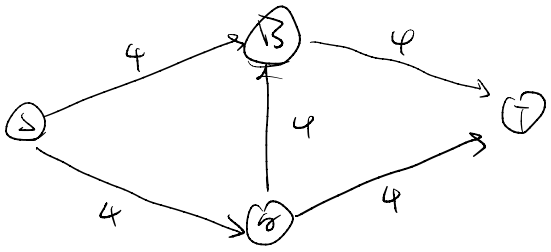
$2^4 \% 11$ → 5 → B

$2^8 \% 11$ → 3 → A

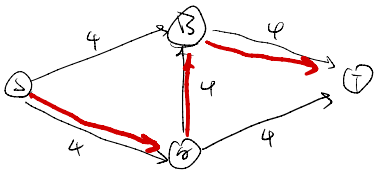
$3^4 \% 11 = 4$ = $5^8 \% 11 = 4$

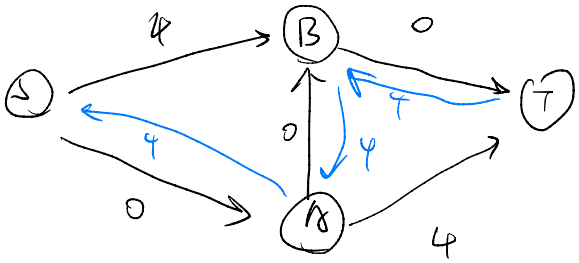
$(2^8 \% 11)^4 \% 11$ $(2^4 \% 11)^8 \% 11$

Ford-Fulkerson flow . maximum flow

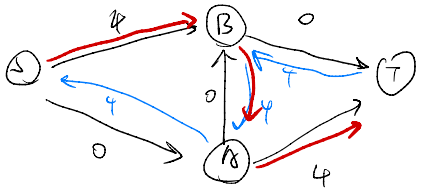


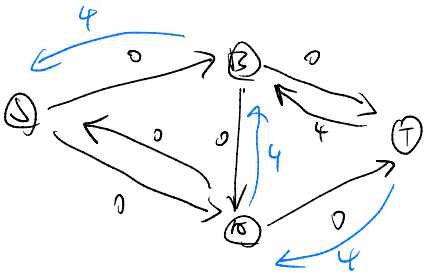
S A B T 4 flow





S B A T 4 flow





done 4 + 4 = 8