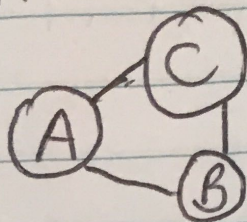
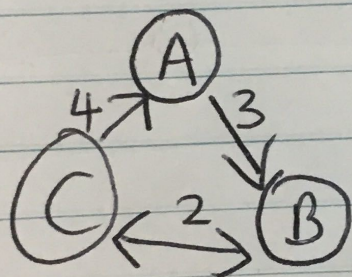


MATH NOTES:

GRAPHS:



this is an undirected (no arrows)
unweighted (no numbers)
graph



this is a
directed, weighted
graph (it has
arrows and
numbers).

RELATIONS: Reflexive, symmetric, transitive.

	S	R	T
$=$			
$\geq$			
$\leq$			
$>$			
$<$			

My really un-scientific way of remembering:
= includes all relations.
S for symmetric
only occurs once (you could think S for singular)

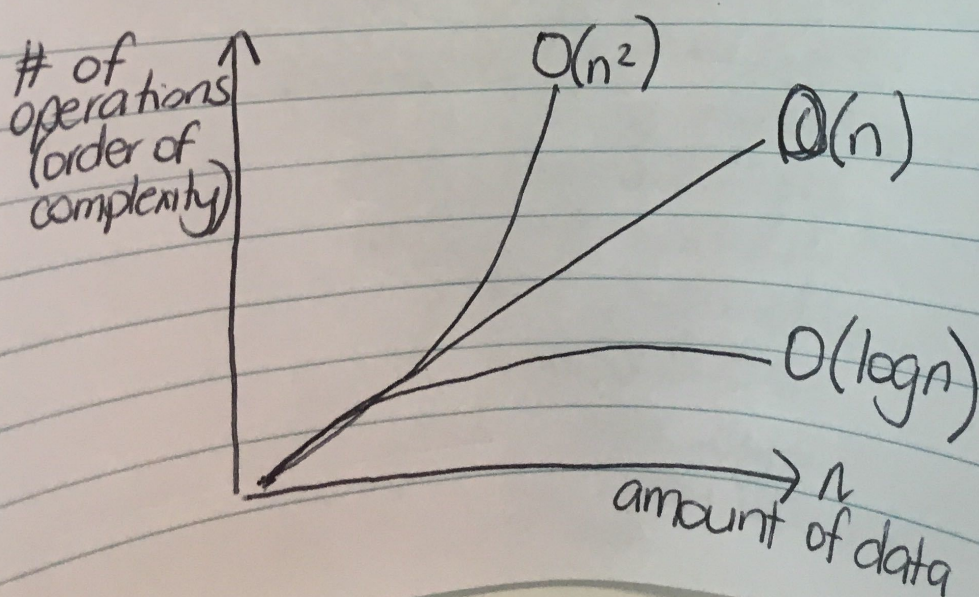
$\geq$ and $\leq$ have two parts to them (the $>$ and the $-$), and they apply to two relations; R & T , which leaves $>$ and $<$ to just be transitive.

An example of a transitive relationship would be for x, y, z , if $x > y$ and $y > z$, then $x > z$.

or for

Samara, Gretchen and Harrison
if Harrison is taller than Gretchen
and Gretchen is taller than Samara,
then Harrison is taller than Sam.

ESTIMATING COMPLEXITY / ORDER OF MAGNITUDE



In order of complexity (least to greatest):

- $O(\log n)$ - binary eg. split your list in half each time
- $O(n)$ - linear eg. check through a list
- $O(n^2)$ - quadratic eg. compare all elements of an array with another array

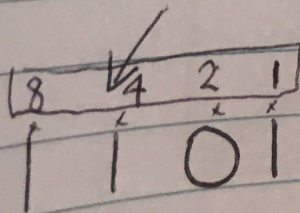
BINARY TO HEX

- Step 1: split into groups of 4
- Step 2: convert each subset of 4 into binary (start with the right hand subset)
- Step 3: combine the results.
... 8, 9, A, B, C, D ...

eg. 11010110

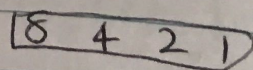
Split into bytes:

1101 and 0110



$$8 + 4 + 0 + 1 = D$$

(because 13 in hex is D)



0110

$$0 + 4 + 2 + 0 = 6$$

combine the two = D6

HEX TO BINARY

... 9, A, B, C, D
10 11 12 13

6D

to make up 6,
we need 1 lot of 4
and 1 lot of 2

2^3	2^2	2^1	2^0
8	4	2	1
0	1	1	0

to get to D (13)
we use one lot of
8 and have 5 left,
then 1 lot of
4 and 1 lot of 1

because
we're
going to
binary

2^3	2^2	2^1	2^0
8	4	2	1
1	1	0	1

then combine:

01101101

eg

3C

$3-2=1$
 $1-1=0$

8	4	2	1
0	0	1	1

to get to C (which is 12)
 $12-8=4$ (one lot of 8)
 $4-4=0$ (one lot of 4)

8	4	2	1
1	1	0	0

fill the rest with
0

00111000

(5)

HEX TO DECIMAL

1, 2..., 9, A, B, C...

10, 11, 12...

7DE

because its
base 16

16^3 16^2 16^1 (16^0)
4096 256 16 1
7 13 14

$$7 \times 256 + 16 \times 13 + 14 \times 1 = 2014$$

9B

because
hex is base 16

16^2 16^1
256 16
9

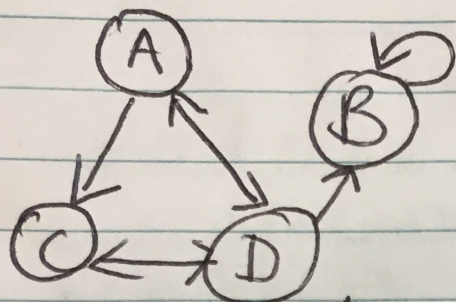
(16^0)
1
 (11)

because B is 11

$$9 \times 16 + 11 \times 1 = 155$$

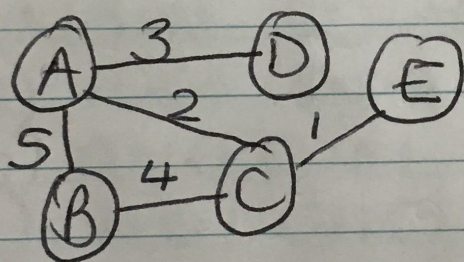
EXERCISES:

① what kind of graph is this:



② draw the edge list E and adjacency matrix for the graph above

③ what kind of graph is this:



④ write the edgelist and adjacency matrix for the graph above

⑤ what are the properties of the relation described as = ?

⑥ what are the properties of the relation described as $\leq$

⑦ what are the properties of the relation described as $>$

⑧ give an example of a transitive relationship

⑨ BINARY TO HEX convert the following bin to hex

- a) 1001 1000
- b) 0110 0111
- c) 1101 0110
- d) 0011 0101

⑩ HEX TO BINARY convert the following hex to bin

- a) 3C
- b) D4
- c) 2D
- d) C3

⑪ HEX TO DECIMAL
convert the following hex to decimal

a) 3C

b) D4

c) 2D

d) C3

⑫ Rank in the order of complexity
(greatest to least)
think of order of complexity
as number of operations:

$O(n)$

$O(\log n)$

$O(n^2)$

⑬ write a ruby or js method/
function to convert base 10
to base 2.

(You can write in pseudo
code).

⑭ BINARY TO DECIMAL
convert from base 2 to base 10

a) 1101 0110

b) 0110 1101

c) 0100 1011

d) 1011 011

⑮ Bitwise operations

AND

$$\begin{array}{r} 11010001 \\ \& \underline{01110110} \end{array}$$

$$\begin{array}{r} 10110110 \\ \& \underline{11001001} \end{array}$$

$$\begin{array}{r} 01001101 \\ \& \underline{10110111} \end{array}$$

$$\begin{array}{r} 11111111 \\ \& \underline{00101000} \end{array}$$

OR

$$\begin{array}{r} 10110101 \\ | \underline{10001001} \end{array}$$

$$\begin{array}{r} 10110011 \\ | \underline{10011011} \end{array}$$

$$\begin{array}{r} 01000000 \\ | \underline{10110110} \end{array}$$

$$\begin{array}{r} 11111111 \\ | \underline{00000000} \end{array}$$

XOR

$$\begin{array}{r} 10110111 \\ \wedge \underline{01001011} \end{array}$$

$$\begin{array}{r} 10110111 \\ \wedge \underline{01110001} \end{array}$$

$$\begin{array}{r} 10110110 \\ \wedge \underline{01001011} \end{array}$$

$$\begin{array}{r} 01000100 \\ \wedge \underline{01111010} \end{array}$$

(16) draw an OR truth table

(17) draw an AND truth table

(18) draw an XOR truth table

(19) given A is the set of all ~~letter~~ vowels in the english language, what is the complement of A ?

(20) if $A = \{1, 2, 3, 4\}$ and $B = \{2, 3, 6, 9\}$
what is the intersection of A and B eg. $A \cap B$?

(21) if $A = \{1, 2, 3, 4\}$ and $B = \{2, 3, 6, 9\}$
what is $A - B$?