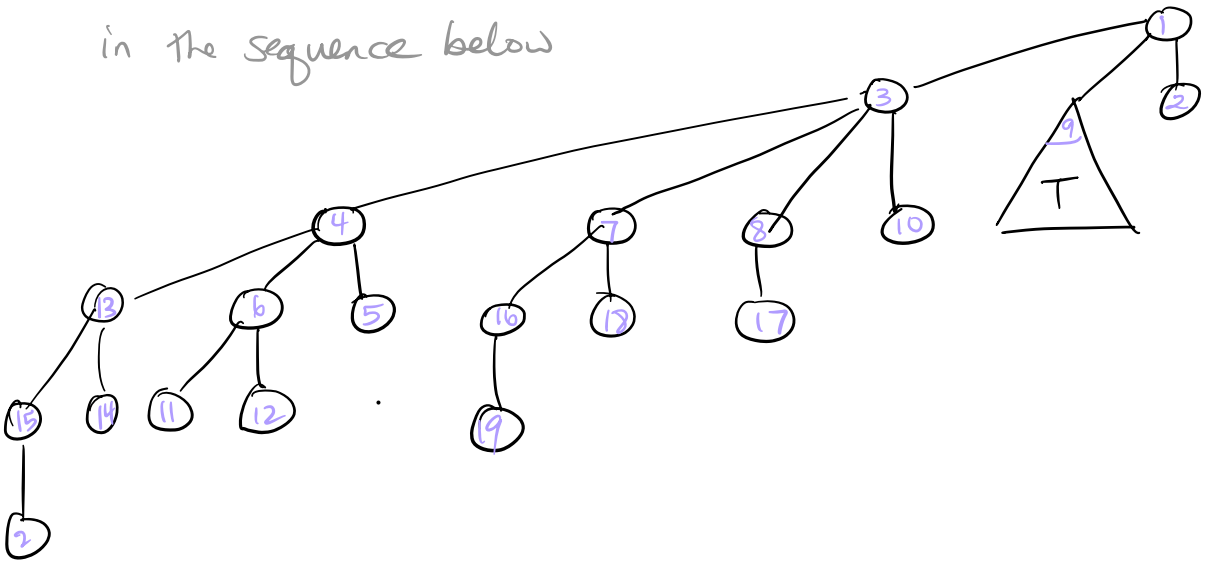
Draft Test 2 CSCI 429 Nov 2023

1. (10 marks) Fib Heaps.

Show the result of the PrintHeap() operations in the sequence below

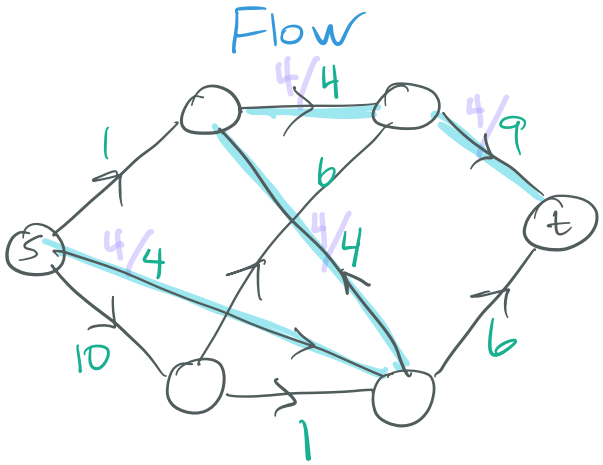


Delete (9); PrintHeap();

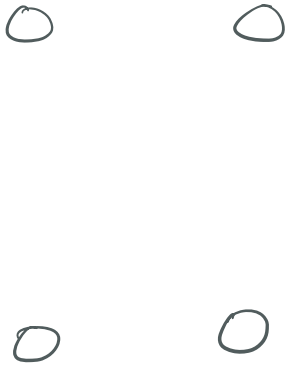
Delete (14); PrintHeap();

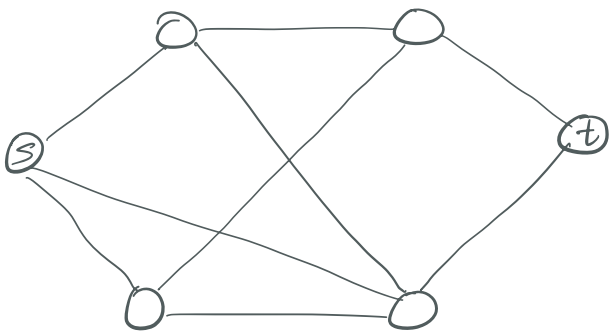
2. (10 marks) Use the Flow Augmenting path alg on the Network below. Show each flow and each residual network. Give the final, optimal flow and show a min cut.

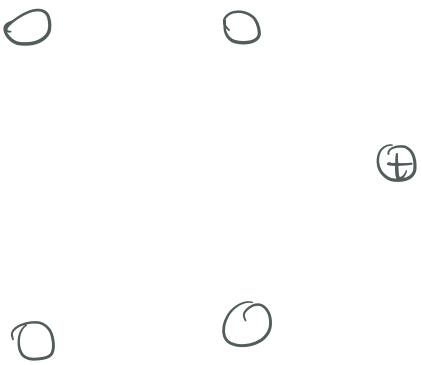
The first augmenting path is given, below.

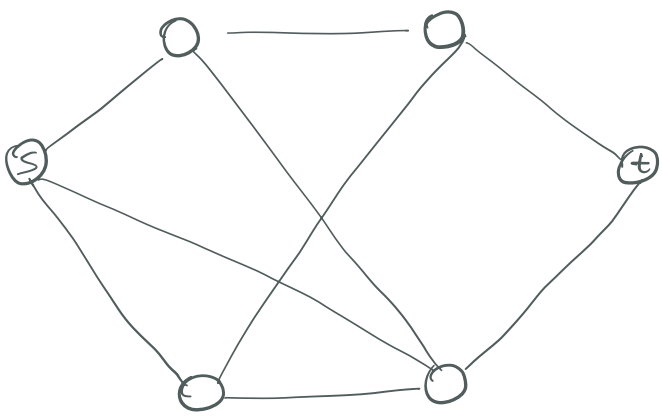


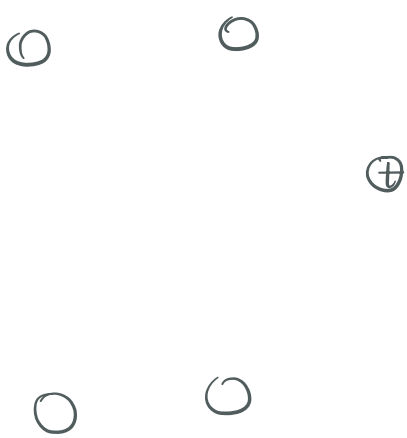
Residual



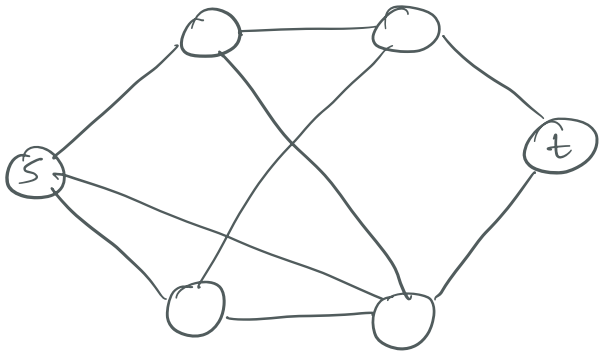








Flow



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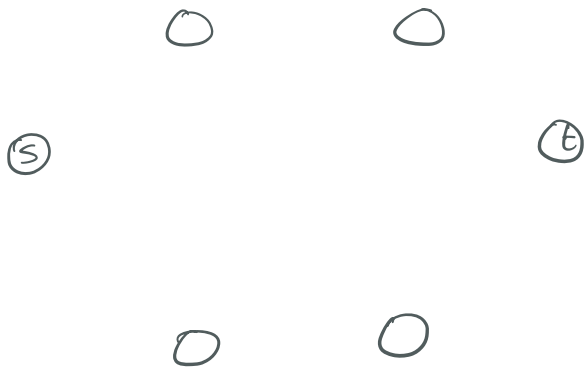
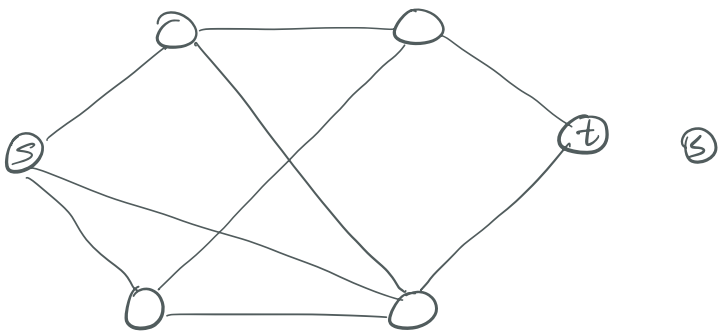
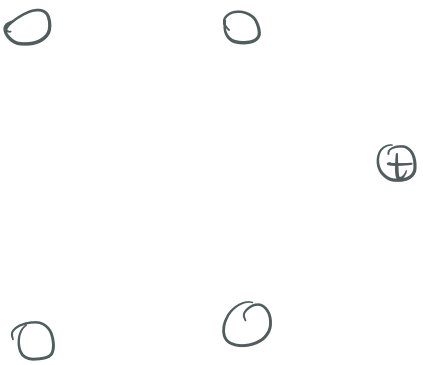
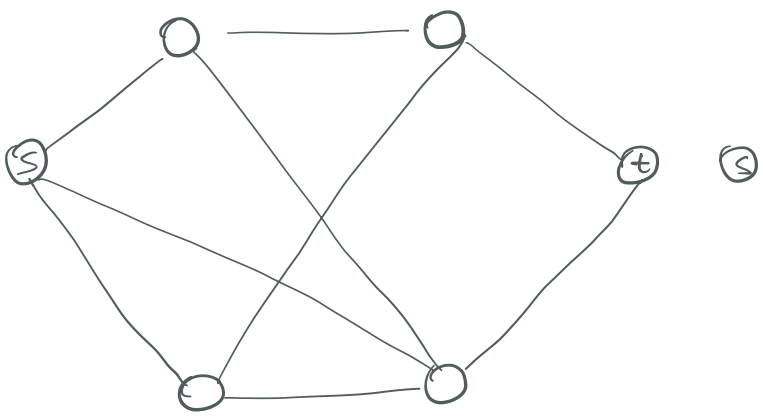
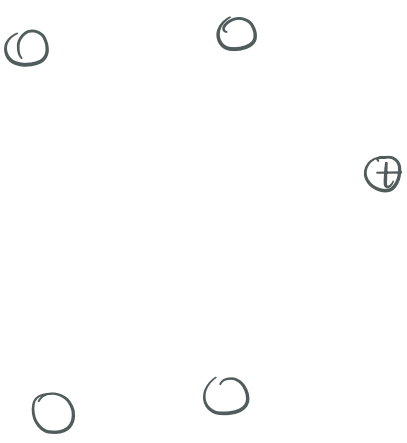


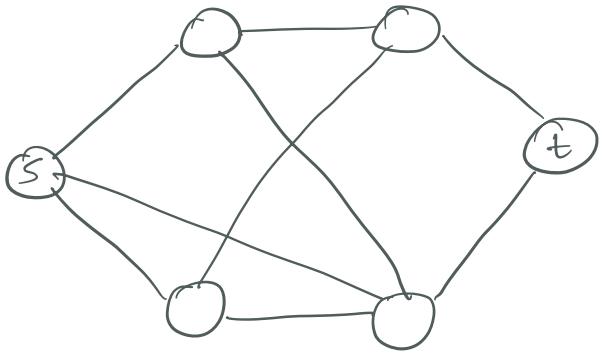




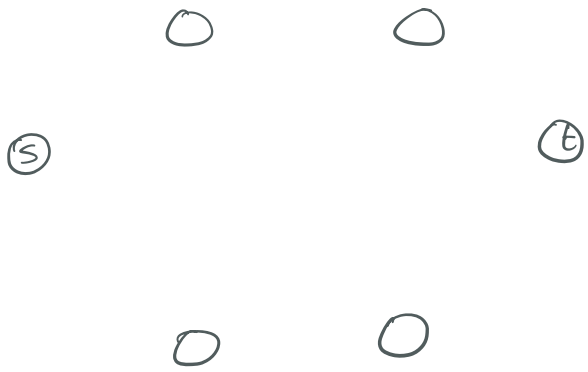


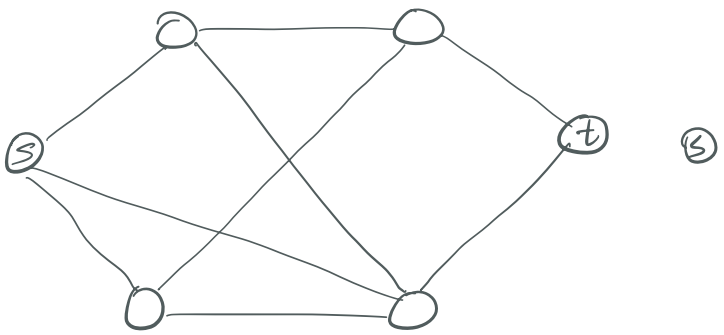


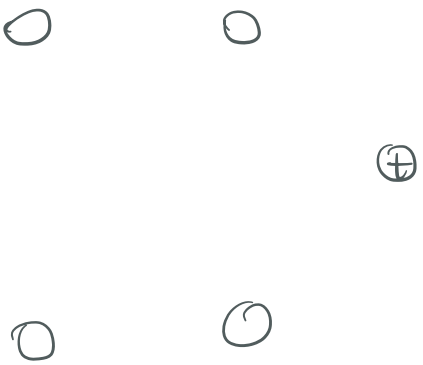
Flow

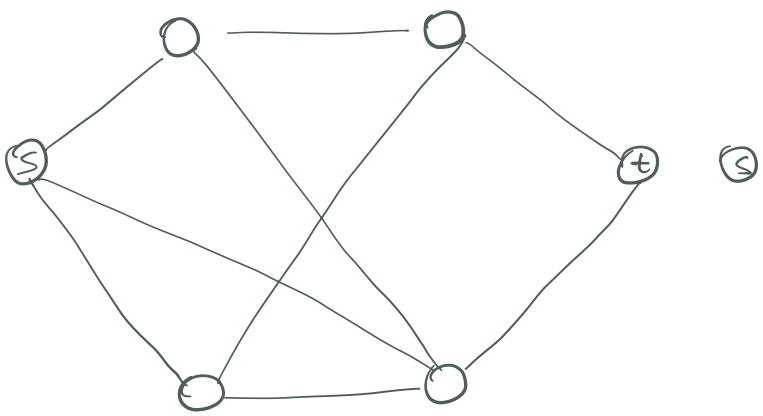


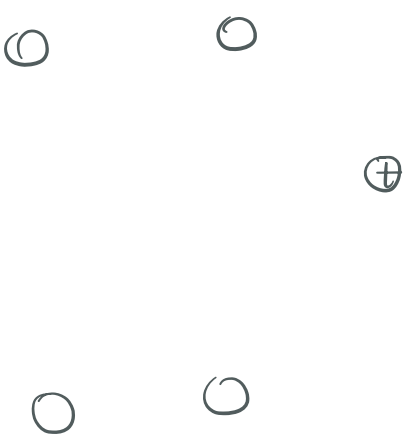
Residual



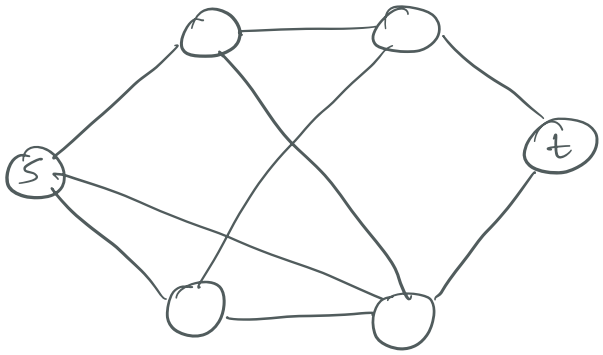




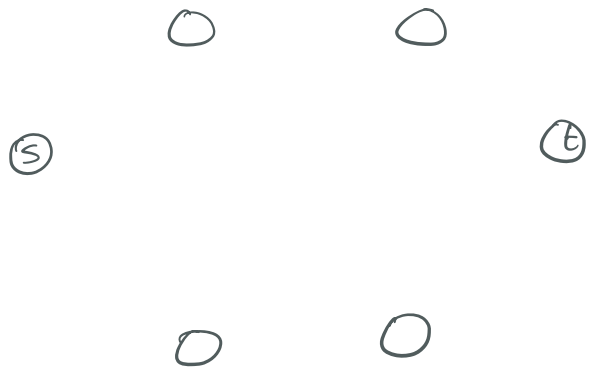


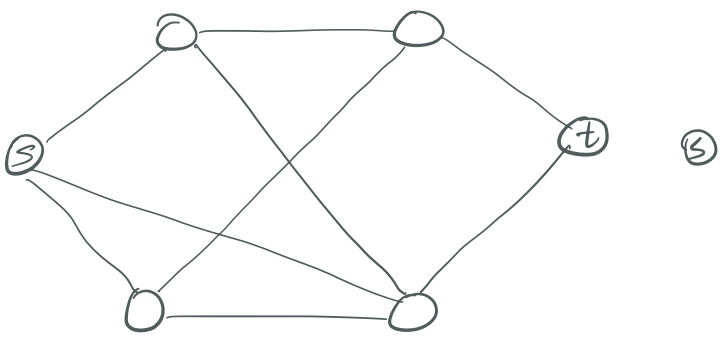


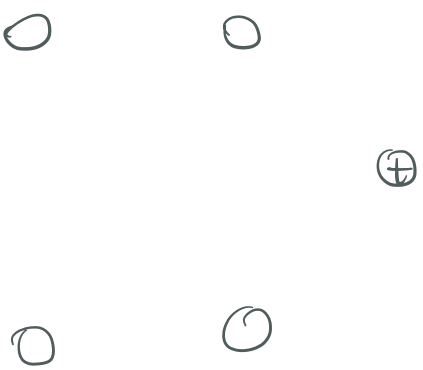
Flow

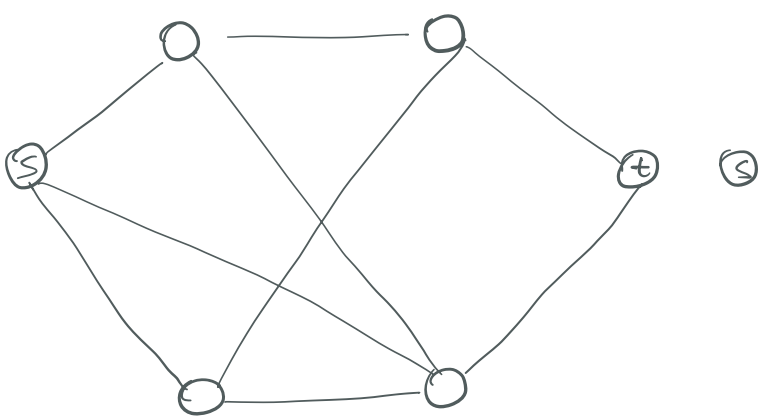


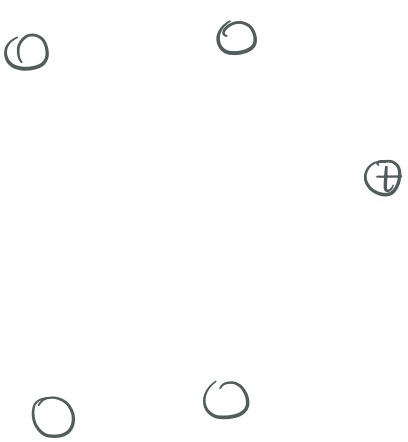
Residual











3. [10 marks] Use the Gale-Shapley algorithm to find a stable matching, given the preferences below:

A	B	C	D
w	w	w	x
x	y	x	w
y	z	z	z
z	x	y	y

w	x	y	z
D	B	C	A
C	C	D	B
B	D	A	C
A	A	B	D

Show each tentative match, and give the final matching.

4 [10 marks] Give a Dynamic Programming Solution to the Dance Contest Problem.

You will attend a dance contest.

You know exactly how many points you will obtain in each dance if you dance it, eg $P[i] = 20$ means 20 pts if you dance dance i

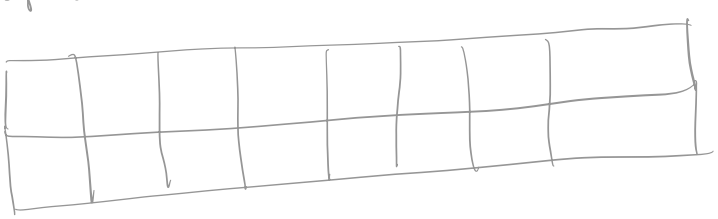
But - each dance requires a (possibly 0-length) rest period after dancing it, so if you dance dance i, you must skip $S[i]$ dances directly afterwards.

Eg.

	1	2	3	4	5	6	7	8
P	20	5	3	11	17	4	10	6
S	4	0	2	1	3	1	0	0

It is possible to dance dances 1, 6, 8 for 30 points. Can you do better?

Come up with a Data Structure (hint: it looks like this)



and say how you will fill it with values, and in the end how you can extract the best set of dances to maximize points. Show your results on the following input:

2	3	10	4	3	1	6	2	9
2	2	4	0	1	0	2	1	0

5 [5 marks] Show how to construct a Network out of the following Project dependencies and values. Show the min cut, and tell what the corresponding set of feasible project is, and its value. In my world,  means "p must be done if q is to be done".