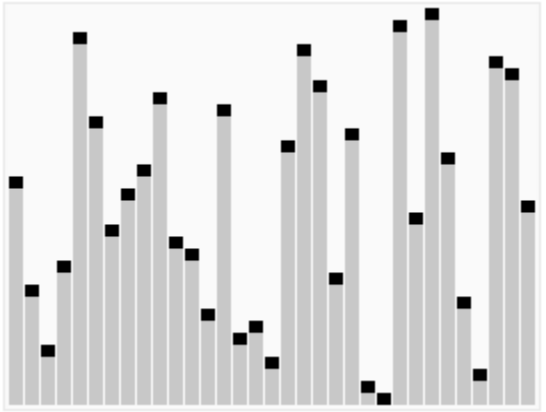
HW2

EE 4033 Algorithms, Fall 2018

107/10/24

Hand-Written Problems

- **Problem 1**
  - Solve the recurrence for randomized *quicksort*



$$T(n) \leq O(n) + \frac{1}{n}\sum_{i=1}^{n-1}\big(T(i) + T(n-i)\big)$$

Hand-Written Problems

- **Problem 2**
  - Stealing goods from a list of houses

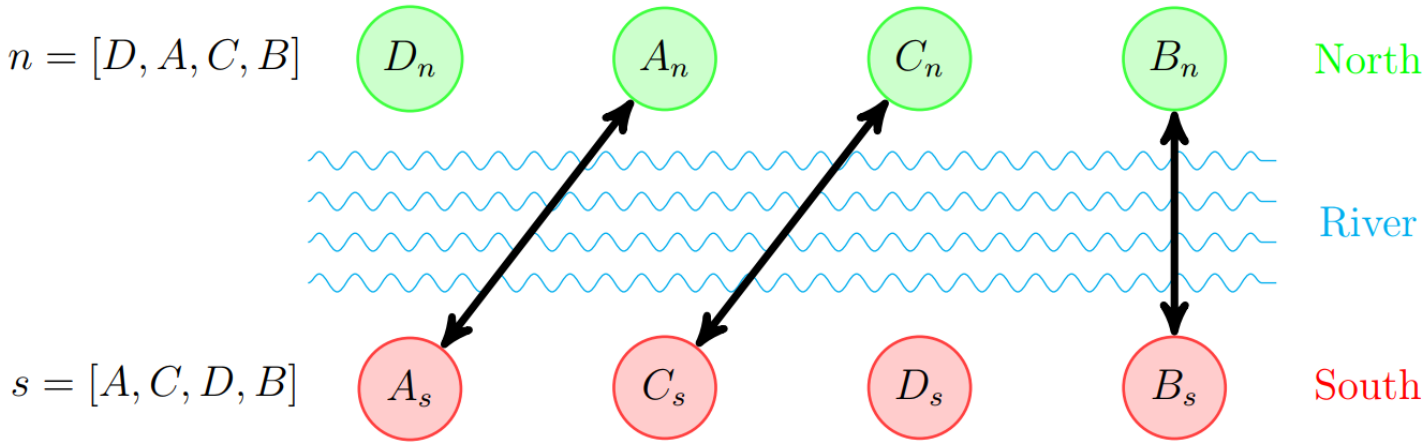
$v[1]$	$v[2]$	$v[3]$	$v[4]$	$v[5]$	$v[6]$	$v[7]$	$v[8]$
8	5	3	9	6	4	10	1

  - **Given**: values of the goods in each house
  - **Target**: get maximum total stolen value
  - **Constraint**: cannot steal in adjacent houses

  - Classic dynamic programming problem

Hand-Written Problems

- **Problem 3**
  - Cities are divided into northern and southern parts
  - Wants to build as many bridges across the river
  - But the bridges cannot intersect



Hand-Written Problems

- **Problem 3**
  - "*Longest Increasing Subsequence*" problem

    0, 8, 4, 12, **2**, 10, **6**, 14, 1, **9**, 5, 13, 3, **11**, 7, **15**
  - Also a classical dynamic programming problem

  - How to relate to the bridge-building scenario?

Remarks

- It is better not to describe your algorithms with codes alone
  - ~~TAs are not compilers~~
  - If you REALLY need to, use pseudocodes instead
  - Better yet, try describing your work in human-understandable words

Programming Problems

- **Problem 1**
  - Find the smallest number whose digits multiply to a given integer p

a) $p = 96$
$N_p = \{\mathbf{268}, 286, 348, 384, 438, \dots, 1268, 1286, \dots\}$
$n_{min} = \mathbf{268}$

b) $p = 1$
$N_p = \{\mathbf{11}, 111, 1111, 11111, \dots\}$
$n_{min} = \mathbf{11}$

c) $p = 23$
$N_p = \emptyset$

Programming Problems

- **Problem 1**
  - Solve the problem using a greedy algorithm

input.txt	output.txt
96 1 20	268 11 45

  - Explain your work in the report

Programming Problems

- **Problem 2**
  - Minimize the penalties of delayed homework submissions

	h_1	h_2	h_3	h_4	h_5	h_6	h_7
Deadline d_i	1	2	3	4	4	4	6
Penalty p_i	25	65	35	50	15	90	5

  - Each homework assignment h_i has a deadline d_i and a penalty p_i for not submitting in time
  - Penalty is a constant no matter how late you submit
  - If $d_i = 4$, submitting h_i on day-4 is okay

Programming Problems

- **Problem 2**
  - Minimize the penalties of delayed homework submissions

	h_1	h_2	h_3	h_4	h_5	h_6	h_7
Deadline d_i	1	2	3	4	4	4	6
Penalty p_i	25	65	35	50	15	90	5

Day#	1	2	3	4	5	6	7
Do Assignment#	h_3	h_2	h_4	h_6	h_5	h_7	h_1
Received Penalty	0	0	0	0	15	0	25

  - Total Penalty = $15 + 25 = 40$ (wants to minimize)
  - Can be solved using a greedy algorithm

Programming Problems

- **Problem 2**

	h_1	h_2	h_3	h_4	h_5	h_6	h_7
Deadline d_i	1	2	3	4	4	4	6
Penalty p_i	25	65	35	50	15	90	5

Day#	1	2	3	4	5	6	7
Do Assignment#	h_3	h_2	h_4	h_6	h_5	h_7	h_1
Received Penalty	0	0	0	0	15	0	25

input.txt	output.txt
1 2 3 4 5 6 7 1 2 3 4 4 4 6 25 65 35 50 15 90 5	3 2 4 6 5 7 1 40

Remarks

- How to parse input arguments?

```
import sys
args = sys.argv
print(args[1], args[2])
```

- Do not hard-define "`input.txt`" or "`output.txt`" into your code
- Do not use `input()` to obtain paths

Remarks

- Read the HW instructions very carefully
  - Failing to follow them may lead to loss of credits
- All the inputs are of arbitrary size
- Use the provided `selfCheck.py` to check the format of your `.zip`/`.tar` file before uploading
  - Do not include redundant files for it might cause troubles when judging

Remarks

- About referencing
  - For each *hand-written* problem, write the collaborators and/or URLs at the beginning or end of each problem
  - For each *programming* problem, write the collaborators and/or URLs at the end of your hand-written answer sheet (not in PDF or as code comments!)
  - If URLs are too long, you can print them out or simply write down the name/title of the webpage