Class: CSc 335

Date: Mar 14, 2023 (Tuesday)

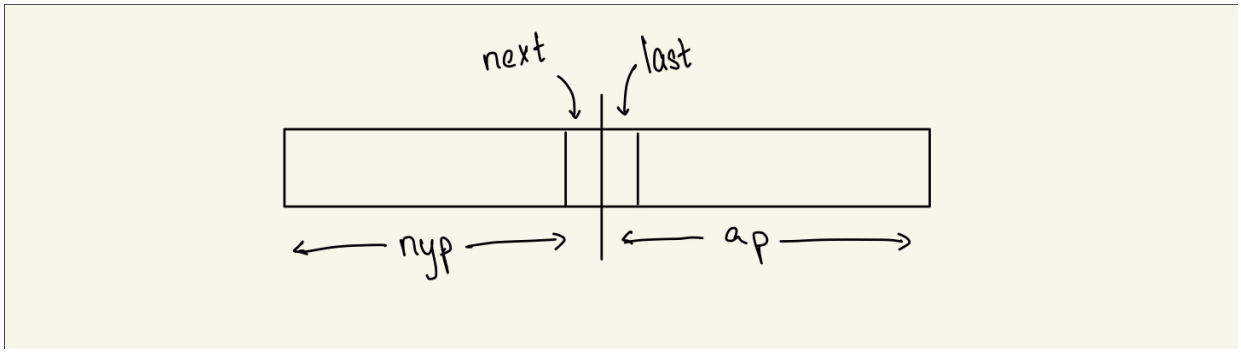
Is the GI (program) we presented last night as simple as it might be? specifically it seems that the `sorted-so-far?` boolean is an artifact of the invariant-based development technique - and if it clutters the code unnecessarily, we'd do well to eliminate it.

How about something like this code

```
(define (iter nyp next last)
  (cond ((zero? nyp) #t)
        ((<= next last)
         (iter (quotient nyp 10)
               (modulo (quotient nyp 10) 10)
               next))
        (else #f)))
```

What is invariant?

- $n = nyp * 10^{numOfDigitsInap} + ap$ &&
- ap is sorted



Sorting

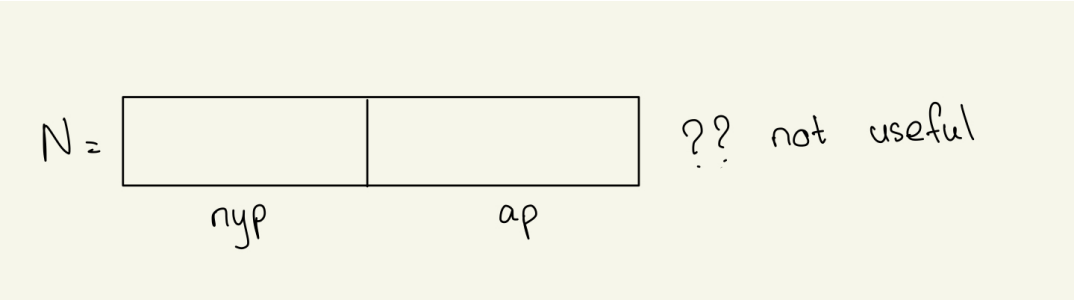
Selection Sort

Note: Which ordering? let's design for $\leq$ left to right

1. Extract the largest digit d from n, leaving the number formed by removing d
    - call this extract parameters = n and returns n without d
    - Some further thoughts
    - It may be easiest to do what we are calling "extract" in 2 steps
        1. Find the largest digit
        2. remove the right-most occurence of the digit
2. Recursive idea
    - [sorted n without d] * 10 + d
    - something like

```
(ssort (extract n)) * 10 + d
```

3. Iterative idea
    - always bear in mind "result-so-far"



        - This drawing gets us off on the wrong foot - because it is the SET of digits in N that we care about, and not the numeric value of N.
        - Would not be an accurate portrayal of the "extract and assemble" approach, because "result-so-far" will consist of the "largest digits" found so far, in sorted order, and these digits - the already extracted ones - was probably not rightmost in N
    - Can we use this observation to simplify the extraction process?
    - Design Idea:
        - digits in N = digits remainig ⊎ digits already extracted
            - ⊎ = MULTISET UNION
        - rsf ≡ digits already extracted in sorted order

Extraction Process

findMaxDigit

- A simple recursive design would defer calls to `max`
- the returned value would be

```
(max (findMaxDigit (quotient n 10) (modulo n 10)))
```

- Need to handle the $n < 10$ case separately

removeMaxDigit

- input n and a max digit in n (d)
- idea: remove rightmost occurance of d (leaving a number)
- Iterative:
    - scan right to left until first d is found
        - picture
        - once d is found return $nyp * 10^{count} + ap$
- Recursive:
    - if rightmost is d, return `(quotien n 10)
    - otherwise, (removeMaxDigit (quotient n 10) * 10) + (n moudlo 10)

MULTISET VS SET

- {1, 1, 2, 3, 3, 3} vs {1, 2, 3}
- One speaks of the underlying set of a multiset

How to return 2 values from a procedure?

- Use prime number: the pair (p, q) could be returned as $2^p\ 3^q$