MA/CSSE 473 Day 17

Permutations by lexicographic order number

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- If you want additional practice problems for Tuesday's exam:
  - The "not to turn in" problems from various assignments
  - Feel free to post your solutions in an ANGEL discussion forum and ask your classmates if they think it is correct.
- Allowed for exam:
  Textbook, calculator, one piece of paper (2 sided)
- Final Exam – Wed, Nov 17, 6 PM
- **Student Questions**
- Exam topics
- Permutations by lexicographic order number

About the exam

- Mostly it will test your understanding of things in the textbook and things we have discussed in class.
- Will not require a lot of creativity (it's hard to do much of that in 50 minutes).
- Many short questions, a few calculations.
  - Perhaps some T/F/IDK questions (3/-1/1)
- You may bring a calculator.
- Open book, but beware of time!
  - No time to read new stuff
  - First do the questions you can do quickly

Possible Topics for Exam

- Formal definitions of O, Θ,Ω.
- Master Theorem
- Fibonacci algorithms and their analysis
- Efficient numeric multiplication
- Proofs by induction (ordinary, strong)
- Trominoes
- Extended Binary Trees
- Modular multiplication, exponentiation
- Extended Euclid algorithm
- Modular inverse
- Fermat's little theorem
- Rabin-Miller test
- Random Prime generation
- RSA encryption
- What would Donald (Knuth) say?

Possible Topics for Exam

- Brute Force algorithms
- Selection sort
- Insertion Sort
- Amortized efficiency analysis
- Analysis of growable array algorithms
- Divide-and-conquer
- Closest Points
- QuickHull
- Merge Sort
- Quicksort
- Binary Search
- Binary Tree Traversals
- Strassen's Matrix Multiplication algorithm
- Basic Data Structures (Section 1.4)
- Graph representations

Side road: Polynomial Evaluation

- Given a polynomial
  $p(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x + a_0$
- How can we efficiently evaluate p(c) for some number c?
- Apply this to evaluation of "31427894" or any other string that represents a positive integer.
- Write and analyze (pseudo)code

Q1-4

Permutations and order

number	permutation	number	permutation
0	0123	12	2013
1	0132	13	2031
2	0213	14	2103
3	0231	15	2130
4	0312	16	2301
5	0321	17	2310
6	1023	18	3012
7	1032	19	3021
8	1203	20	3102
9	1230	21	3120
10	1302	22	3201
11	1320	23	3210

- Given a permutation of 0, 1, …, n-1, can we directly find the next permutation in the lexicographic sequence?
- Given a permutation of 0..n-1, can we determine its permutation sequence number?
- Given n and i, can we directly generate the i^{th} permutation of 0, …, n-1?

Discovery time (with a partner)

- Which permutation follows each of these in lexicographic order?
  - 183647532 471638752
  - Try to write an algorithm for generating the next permutation, with only the current permutation as input.
- If the lexicographic permutations of the numbers [0, 1, 2, 3, 4, 5] are numbered starting with 0, what is the number of the permutation 14032?
  - General form? How to calculate efficiency?
- In the lexicographic ordering of permutations of [0, 1, 2, 3, 4, 5], which permutation is number 541?
  - How to calculate efficiently?