COS 126	General Computer Science	Fall 2016

Written Exam 2 Solutions

1. **Properties of reference types.**

   J E A C G B

2. **Object-oriented programming.**

   C E I B H F A J K

3. **Linked structures.**

   H A I/A D

4. **Sorting and searching.**

   (a) 17–22, 22-33, 10–22, 10–33

   (b) 44–88, 77–88

5. **Symbol tables.**

   (a) `88 33 11 55 44 77 99`

   (b) $n \log n$

   A worst-case input is if all n integers are distinct. In this case, the `while` *loop will construct a BST containing n key–value pairs. So, we expect symbol-table operation to take $\log n$ time each. The* `while` *loop calls* `get()` *and* `contains()` *n times each. The double nested* `for` *loop calls* `get()` *exactly n times.*

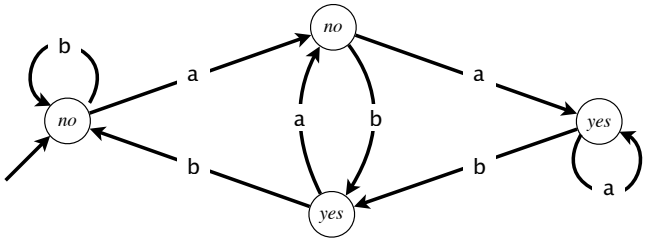
   (c) Sorts.

   It reads integers from standard input and prints them in ascending order to standard output.

6. **Regular expressions and DFAs.**

   (a) `(a|b)*a(a|b)` or `.*a.`

   (b) start state: 0
   accept states: 2 and 3
   a transitions: $2 \to 2$ and $3 \to 1$
   b transitions: $0 \to 0$ and $1 \to 3$



7. **Theory of computing.**

(a) C A B G

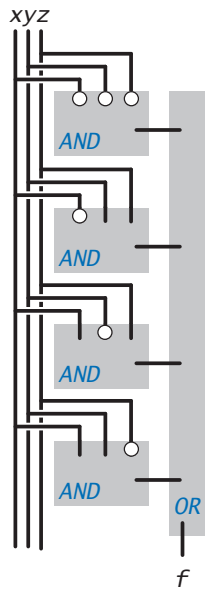
(b) D E A F

8. **Circuits.**

yes ● *no* ○

x	y	z	f
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

yes ● *no* ○



yes ● *no* ○

yes ○ *no* ●

$f = xyz + xy'z' + x'yz' + x'y'z$

yes ● *no* ○

```
public static boolean f(boolean x, boolean y, boolean z) {
    if (x && y) return !z;
    if (x || y) return z;
    return !z;
}
```