Sample Solutions
COS 226 – Final Exam – Spring 2009

1. MST (8pts)
   1. 4, 9, 18, 19, 21, 22, 23, 30
   2. 18, 23, 21, 19, 30, 4, 9, 22

2. KMP (5pts)
   1. A B A B A C C B A
   2. W: 0  X: 5  Y: 1  Z: 4

3. Mystery Code (5pts)
   Answer: d

4. Acronyms (8pts)
   SAT: g (a logic problem)
   KMP: c (substring-search algorithm)
   NFA: h (basis for grep)
   DFA: a (basis for KMP algorithm)
   DFS: d (fundamental recursive method)
   BFS: e (for single source shortest path in unweighted graphs)
   PFS: b (general graph searching scheme)
   NP: f (set of all problems checkable in polynomial time)

5. LZW compression (4pts)
   1. Answer: c (square root of N)

6. 2D trees (6pts)

7. Suffix TST (6pts)

8. String symbol table (7 pts)
   M-ary trie: b
   BST: a, c, d
   TST: a, b
Red-black tree: a,c

9. **RE pattern matching (7 pts)**

10. **RE pattern matching II (4pts)**
    Answer: a

11. **7 sorting algorithms (14 pts)**
    Answer: g, c, b, d, f, e, a

12. **Convex hull**
    Next points; current hull
    A; A
    G; A G
    C; A G C
    H; A G C H
    I; A G I
    F; A G F
    B; A G F B
    D; A G F D
    E; A G F E

13. **Strong Components (3pts)**
    1. First component: A, B
    2. Second component: C
    3. Third component: D,E,F,G

14. **Reduction (4pts)**
    1. Answer: d (Promote them all)

15. **Huffman encoding (4pts)**

16. **Hard problem identification (9 pts)**
    1. Answers: A,B,C,E,G