

NAME:

Final Exam

COS 226 Solutions, Spring 2011

1. MST

A. 1 2 3 4 5 7 9

B. 2 1 3 4 7 5 9

2. KMP

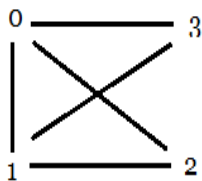
	0	1	2	3	4	5	6	7	8
Z	X	X	X	Z	X	Z	X	X	
X	0	2	3	4	0	6	3	8	9
Y	0	0	0	0	0	0	0	0	0
Z	1	1	1	1	5	1	7	1	1

3. Match the algorithms

F H A C I D G E B J

4. DFS Trace

A.



B. 0: 3, 2, 1
 1: 3, 2, 0
 2: 1, 0
 3: 0, 1

C. dfs(3)
 dfs(0)
 dfs(1)
 check 0
 dfs(2)
 check 1
 2 done
 check 3

```

    1 done
    check 3
0 done
    check 1
3 done

```

5. LZW compression

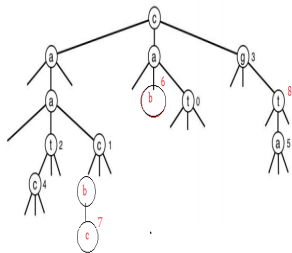
```
in:  A  A A  A A A  B  A A A  A A  B
out: 41   81      82 42      82   81 42 80
```

key	value
AA	81
AAA	82
AAAB	83
BA	84
AAAA	85
AAB	86

6. TST

```
A.
aac (4)
aat (2)
ac (1)
ct (0)
g (3)
ta (5)
ca (missing index) <=== +1
```

B.



7. String sorts

	stable	inplace	sublinear
Quicksort	N	Y	Y
Mergesort	Y	N	Y
LSD string sort	Y	N	N

MSD String sort	Y	N	Y
3-way string quicksort	N	Y	Y



8. Regular Expressions

A. 0→11 0→1
 1→5 1→9 1→2
 4→8
 5→6
 6→7 6→5
 8→9
 9→1 9→10
 10→13
 11→12
 12→11 12→13

B. 0, 1, 5
 2, 6
 2, 6, 7, 8, 9
 3, 7
 3, 6, 7, 8, 9
 7
 6, 7, 8, 9

9. Bellman-Ford

		successful relax	A	B	C	D
phase 1	A→C	X			1	
	A→B	X		1		
phase 2	C→D	X				0
phase 3	D→B	X		-1		

10. Prefix-free codes

code 1 none
 code 2 A B C
 code 3 A
 code 4 A C

11. 3-way partitioning

A A A H H U M U N U K U N U K U M P U U M U

Number of exchanges: 20

12. Linear Programming

Maximize $X_{bt} + X_{ct}$ subject to constraints

$$0 \leq X_{sa} \leq 7$$

$$0 \leq X_{sb} \leq 4$$

$$0 \leq X_{ac} \leq 5$$

$$0 \leq X_{ba} \leq 1$$

$$0 \leq X_{bc} \leq 2$$

$$0 \leq X_{bt} \leq 6$$

$$0 \leq X_{ct} \leq 3$$

$$X_{sa} + X_{ba} = X_{ac}$$

$$X_{sb} = X_{ba} + X_{bc} + X_{bt}$$

$$X_{ac} + X_{bc} = X_{ct}$$

13. Subsequence

A. `st.put(next, new Queue());`

B. `Queue q = st.get(next);`

C. `st.delete(next);`

D. `st.put(next+d, q);`

E. $N \log Q$

F. N

14. Maxflow

A. i, iii, v,

B. i, ii, iii, vi, viii

15. Intractibility

	P	NP	NP-complete
linear equation satisfiability	Y	Y	N
linear inequality satisfiability	Y	Y	N
0-1 integer linear inequality satisfiability	? or N^*	Y	Y
boolean satisfiability	? or N^*	Y	Y

integer factoring

?

Y

N or ?

16. What is the shortest distance between 2 jokes?



a straight line