Quiz 2. COL 106. Solutions

Rubric for all questions: 2 marks for fully correct solution, 0 otherwise

Q1: Quick-sort: number of cmp
Answer: (c)
if the pivot happens to be the smallest or largest element in the list, the number of comparisons would be: (n-1) + (n-2) + (n-3) + …. + 1
For any other sequence, as it divides the left and right with more than 1 members each, the number of comparison would always be lesser, regardless of other implementation details

Q2: Skip-list: Probability
Answer: (7/8)^7
If mentioned the assumption that duplicates aren't added to the skip-list: (7/8)^6
Here, as we take the level containing infinities as the last level,
for any key, we should stop at most at level 3
P(Table has at most 4 levels)
= P(Stopping on most at level 3 for all 7 insertions)
= P(Stopping on most at level 3) ^ 7
= (P(Stopping on level 1) + P(Stopping on level 2) + P(Stopping on level 3)) ^ 7
= ((1/2) + (1/4)+(1/8)) ^ 7
= (7/8))^7
= (0.875) ^ 7 (Also valid)

Q3: Quick-sort: possible pivots
Answer: 14, 27, 30
Here, after the first partition, all the elements lesser than the pivot need to be on the left of it and all those greater than pivot on the right of it.
Rubric: 2 marks for correct answer (exactly 3 values), 0 for incorrect

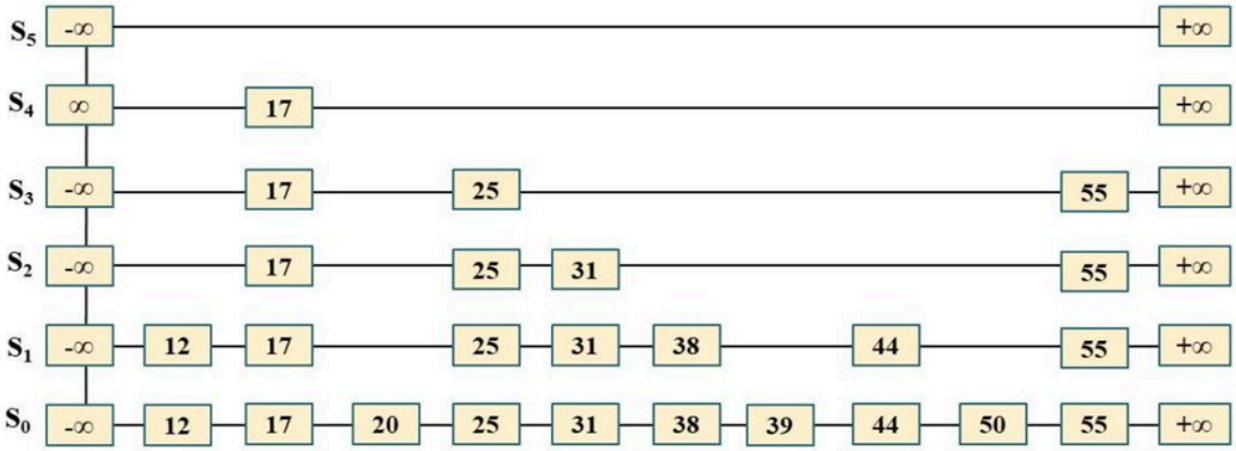
Q4: Hashmap of binary string
Answer: 2
(1+(11)^4 + (11)^7)%7
= (((11%7)^(4))%7 + ((11%7)^(7))%7+1) %7
= ((4^4)%7 + (4^7)%7 + 1) % 7
= (2*(16%7) + 4*((16%7)^3)%7 + 1) % 7
=(4 +4+1)% 7
= 2

Q5: Merge-sort output
Answer:

25 47 ** 12 74 ** 12 25 47 74 ** 15 90 ** 20 40 ** 15 20 40 90 ** 12 15 20 25 40 47 74 90 **

Q6: Dice
Answer: 10
PE=(1/9), PO=(2/9)
S1 = PE(2+4+6) + PO(1+3+5)
S = 3S1 = (1/3)(12) + (2/3)(9) = 10

Q7: Skip-list: search for 50



Answer: 13
The following is the sequence of accesses:
S4: 17
S3: 17, 25, 55
S2: 25, 31, 55
S1: 31, 38, 44, 55
S0: 44, 50

Q8: Sorting time completixy
Answer: (a)
QS = O(nlogn), IS = O(n), SS = O(n^2)

Q9: Hashing: search for 2
Answer: 6
Modulo values for the keys to be inserted: 0, 0, 0, 9, 4, 5, 1, 1
The table after insertions is:

0	1	2	3	4	5	6	7	8	9	10
11	121	33	100	4	93	1			75	

After deleting 33, locations accessed would be: 2,3,4,5,6,7

Q10: Hashing: insert in table
hash f(x) for the keys: 6, 2, 5, 5, 5, 5
hash_2(x) for 47, 33, 75: 3, 2, 5

Which makes final positions for them: 1, 0, 3
Answer:

0	1	2	3	4	5	6
33	47	93	75		40	76