COT 4210 Program #4: How Many Strings are Accepted?

The Problem (dfacount.java)

Given a description of a DFA and an integer k, determine the number of strings of length k that the DFA accepts. Since this number might be very large, you are to just provide your answer mod $10^9 + 7$. (Note: in order to avoid overflow, please use the data type long.)

Note: This is a non-decision version of Question 1 from Quiz 3, Part A.

Algorithm Hint

Part of the fun of this problem is coming up with the algorithm. (I would argue that this is 90% of the fun.) However, some students may have difficulty doing so. Thus, I'll offer two levels of hints for students who request them. These won't affect your grade at all, but I know that some students enjoy trying to figure things out on their own and I don't want to kill their joy by putting the hint on the assignment directly. If you decide you want a hint, you must visit me in office hours and ask for it. At that point, I'll email you the paragraph I was going to write in the description. If, after two days of mulling that over, you still want further guidance, please visit my office hours and I can verbally give you some more guidance.

Input Format (standard input)

The first line of the input will contain a single positive integer, *n (n ≤ 25)*, representing the number of DFAs in the input.

For each DFA, the first line will have three space separated positive integers, *s (s ≤ 50)*, representing the number of states, *v (v ≤ 10)*, representing the size of the input alphabet, and *k (k ≤ 100)*, representing the length of strings to consider. The states of the DFA will be 0 through *s*-1, and the input alphabet will be the first *v* lowercase letters. **The start state of the DFA is state 0.** The second line will contain a positive integer, *a (a ≤ s)*, representing the number of accept states in the DFA. This will be followed by a space and *a* space separated integers in increasing order, representing the states of the DFA that are accept states. Each of these integers will be in between 0 and *s*-1, inclusive. The next *s* lines will contain the transition function for the DFA with the jth integer on the ith line representing where to move in the DFA from state i when reading the jth letter, where $0 \le i < s$ and $0 \le j < v$.

Output Format (standard out)

For each input case, output, on a line by itself, the number of strings of length *k* that are accepted by the DFA, modulo 10^9+7.

Implementation Restrictions

1) Write your program in Java, with standard input, standard output.
2) Submit **dfacount.java** via WebCourses.

```
3
5 2 6
3 1 2 3
1 1
2 3
4 4
4 3
4 4
4 2 5
1 0
0 1
2 3
1 2
0 1
4 2 100
1 0
0 1
2 3
1 2
0 1
```

```
2
6
996061887
```

Note: For the first sample case, the 2 accepted strings of length 6 are abbbbb and bbbbbb. For the second sample case, the 6 accepted strings of length 5 are aaaaa, aabba, abbaa, baaba, bbaaa and bbbba.