COT 4210 Program #5: 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.)

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 $(n \leq 25)$, representing the number of DFAs in the input.

For each DFA, the first line will have three space separated positive integers, s $(s \leq 50)$, representing the number of states, v $(v \leq 10)$, representing the size of the input alphabet, and k $(k \leq 100)$, 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 $(a \leq s)$, 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 $0 \leq i < s$ and $0 \leq j < v$.

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.