**(1) Problem 22.2**

If yes, the statement in the question contradict with the result.

If no, the statement in the question is also contradict with the result.

So, neither of the answer is correct.

**(2) Problem 22.9**

(a) Counter example: $f(6,1) = 3 = f(2,3)$

(b) Direct Prove:

(i) Let $B=1$, $A=2n$, $n \in N$

(ii) $f(a,b) = 2n * ½ = n$

(iii) We can map $f(a,b) \rightarrow n$

(iv) $f(a,b)$ is not injective, it is surjective

(c) It is not injective, so it can't be surjective

**(3) Problem 22.25**

(a) Cardinality of {0,1} is smaller than N. There exists a one-to-one mapping from {0,1} to N. for example, f(0)=1, f(1)=2. Countable set includes the finite set. {0,1} is finite. So, {0,1}→N is countable.

(b) Cardinality of N is greater than {0,1}. When the set N points to {0,1}, there will be f(1)=0 and f(2)=0, which is not one-to-one. So, N→{0,1} is not countable.

**(4) Problem 23.33(b)**

(i)

String whose number of 0s is not divisible by 4

$= \overline{1 * \cdot (1 * 01 * 01 * 01 * 01) * \cdot 1 *}$

(ii)

Strings whose number of 0s is not divisible by 4

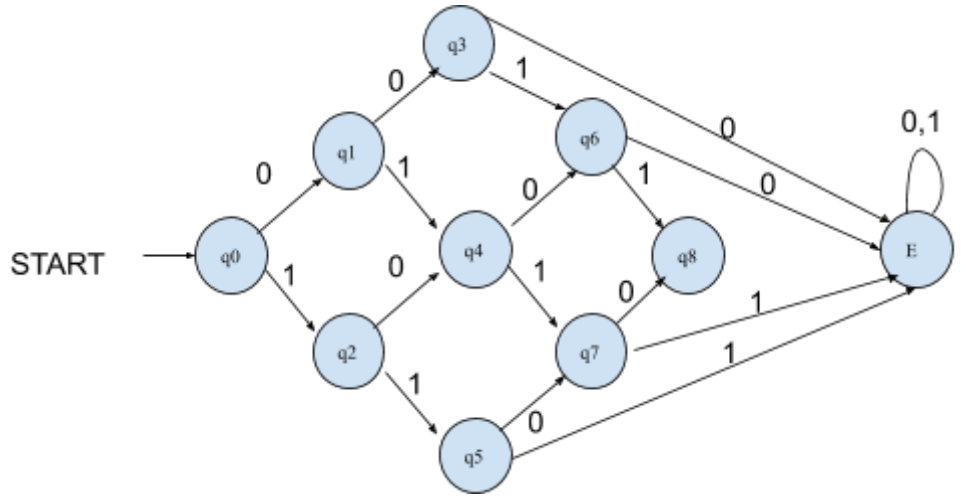
$= 1* \cdot \{1*01*01*01*01\}* \cdot 1* \cdot (\{1*01*\} \cup \{1*01*01*\} \cup \{1*01*01*01*\})$

**(5) Problem 24.3(d)**

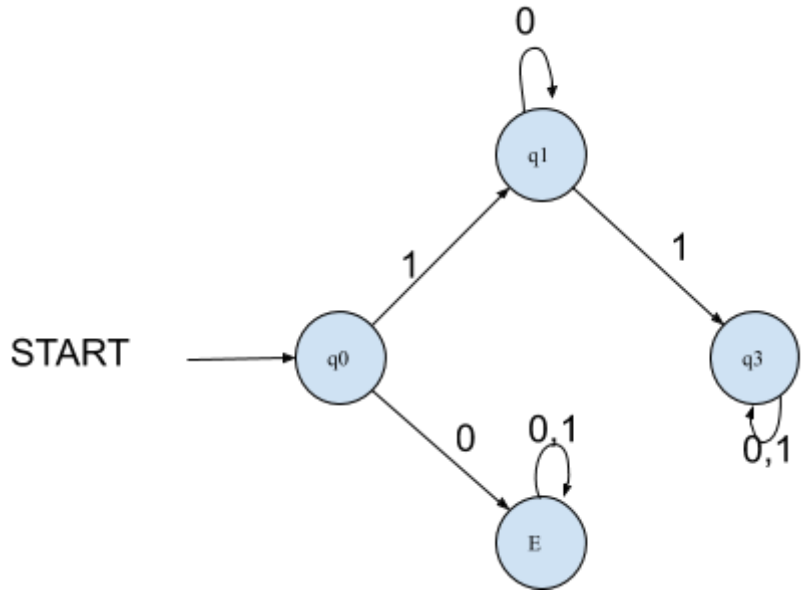
(i) Binary string contains at least one “1”, total number of “1” shouldn’t be divided by 3

(ii) $\overline{0^* \cdot (0^*10^*10^*10^*)^* \cdot 0^*}$

(6) Problem 24.11(z)



(7) Problem 24.51(b)

1. 

2. This language cannot be built with DFA, because DFA has no memory. It cannot remember how many 1's has passed. There's only finite number of states we can store. However, there might be infinite number of states.