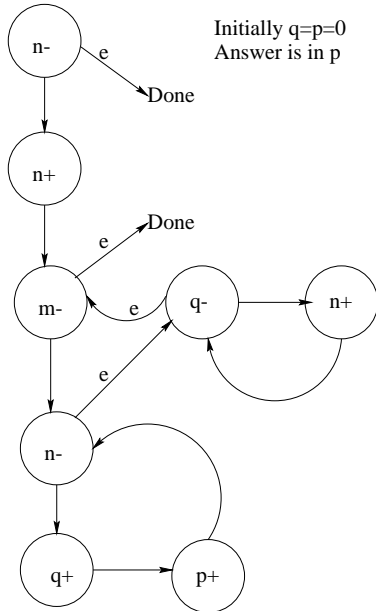


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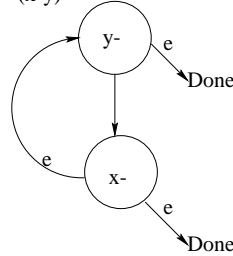
Solutions to Homework 1

Handout #1

MULTIPLYING 2 NUMBERS ($m \cdot n$)
USING ABACUS



SUBTRACTION OF 2 NUMBERS
($x-y$)



Answer is in x . If the original values of x and y are needed, then use 2 more boxes.

Handout #2

Problem 1

Proof of $\emptyset^+ = \emptyset$: **Claim** $\emptyset^i = \emptyset \forall i \geq 1$. This is obviously true for $i = 1$. Assume this is true for $i \leq n$. Consider $i = n + 1$. By definition $\emptyset^{n+1} = \emptyset \emptyset^n = \emptyset \emptyset$ (by induction hypothesis) $= \emptyset$. Hence it is true for all i .

Now, by definition $\emptyset^+ = \bigcup_{i \geq 1} \emptyset^i$. The RHS consists of only empty sets and union of countably finite empty sets is empty. Hence $\emptyset^+ = \emptyset$.

By definition, $\emptyset^* = \emptyset^0 \cup \emptyset^+ = \emptyset^0$ (from the previous proof), But by definition $\emptyset^0 = \{\epsilon\}$. Therefore $\emptyset^* = \{\epsilon\}$.

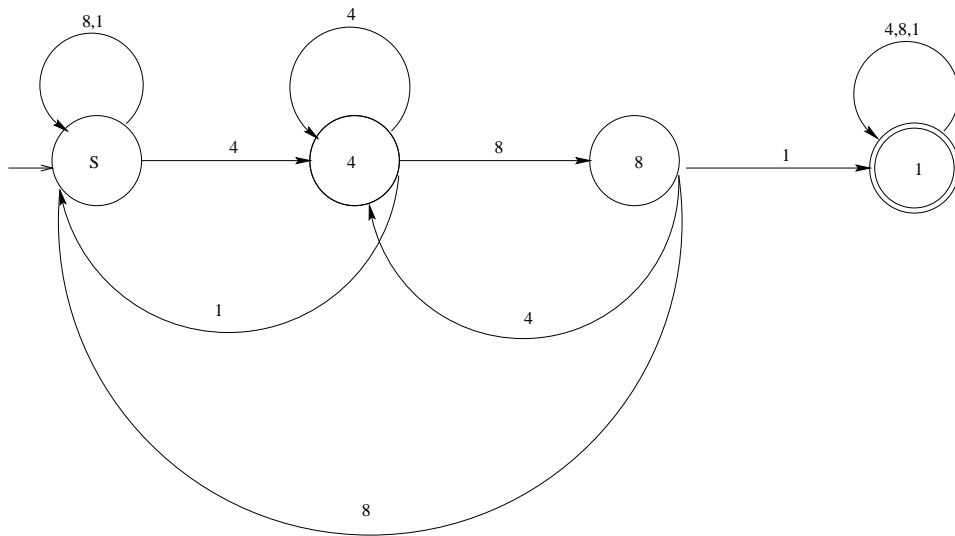
- a) YES
- b) YES
- c) NO
- d) YES
- e) YES
- f) NO

Problem 2

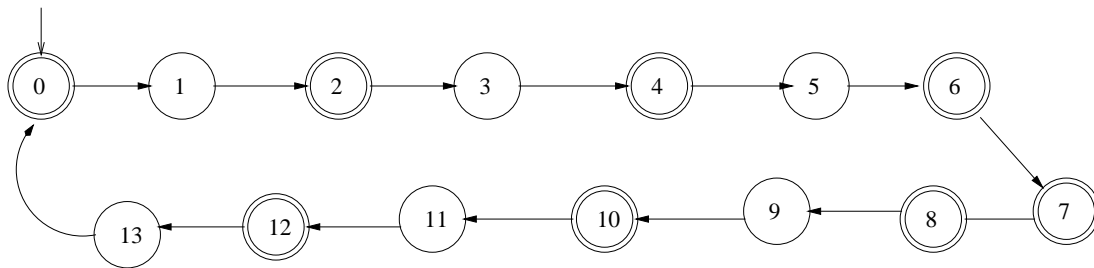
- a) $(A \cup B)^*$
- b) $(AB)^*$
- c) A^*B^*
- d) $\bigcup_{i \geq 0} A^i B^i$

Handout #3

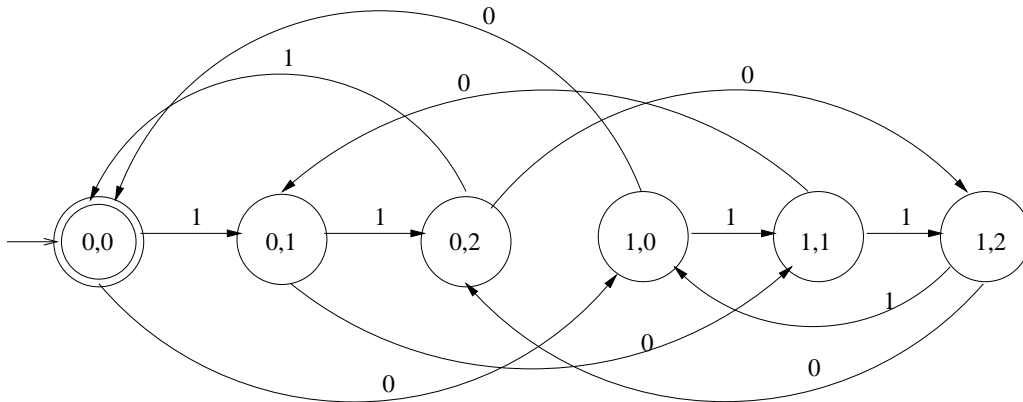
Problem 1



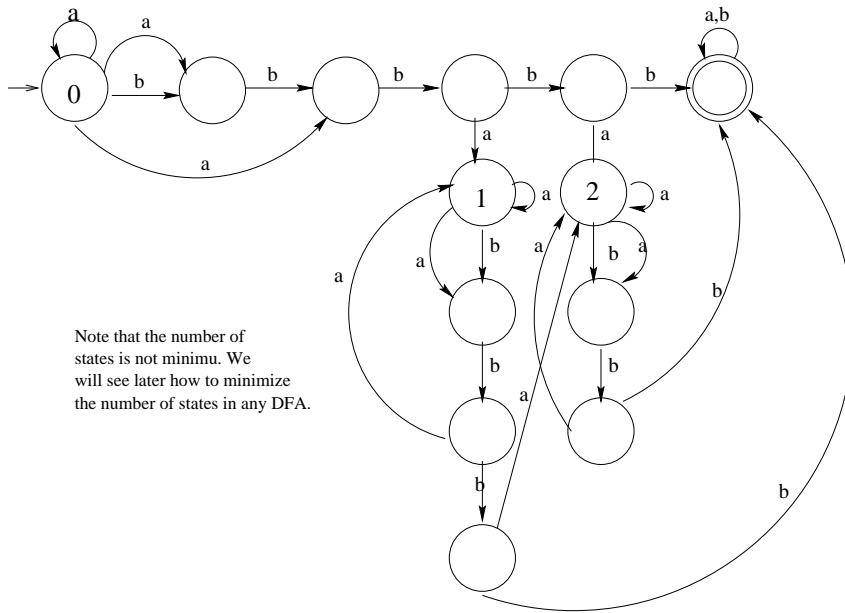
Problem 2



Problem 3



Problem 4



Problem 5

