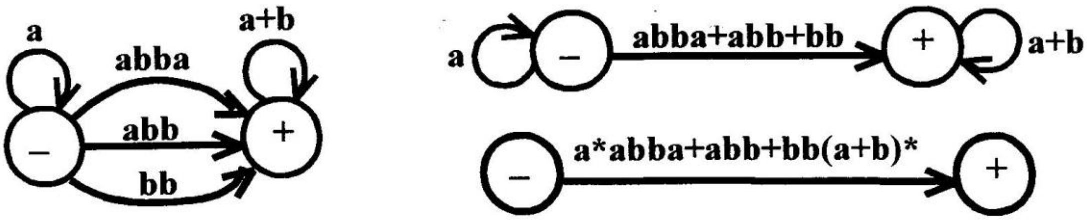
University of Ottawa
School of Information Technology and Engineering
CSI 3104, Winter 2011

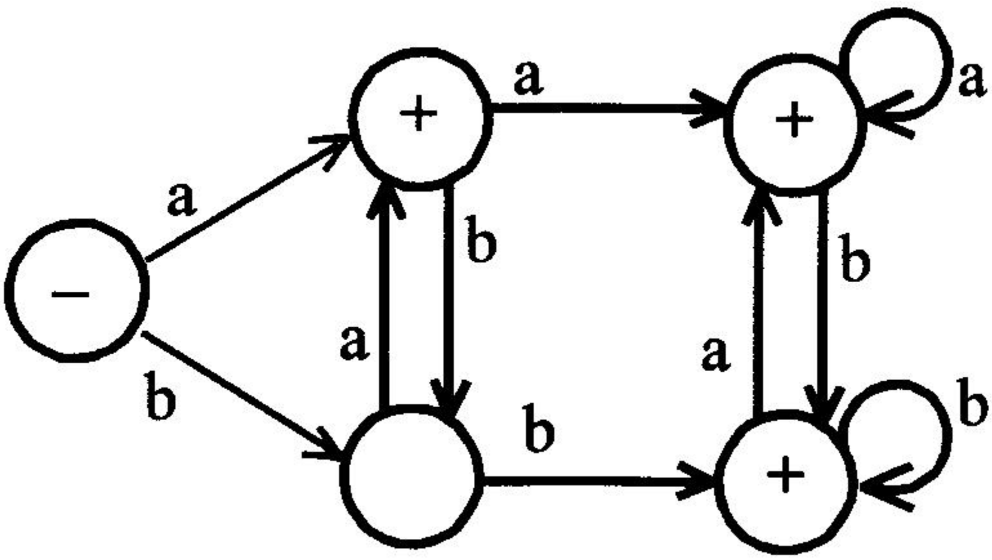
<u>Assignment #2 Solution</u>

Exercise # 1 (v) page 142

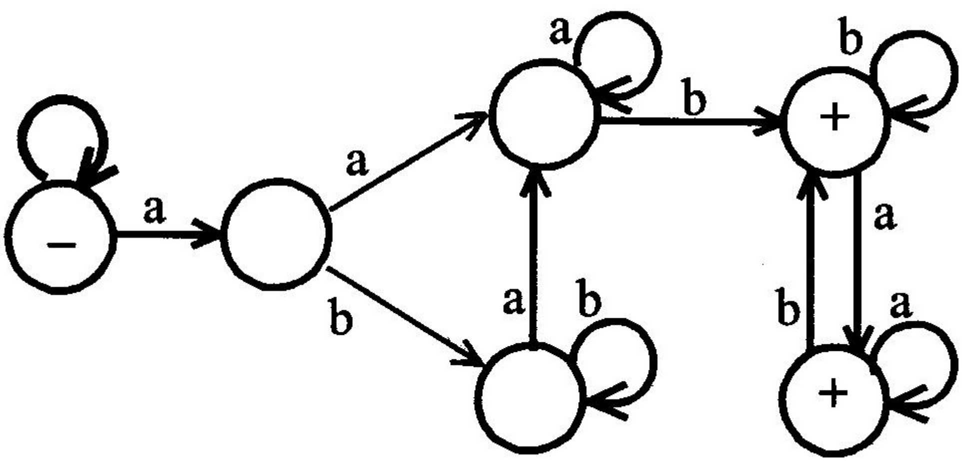
(v) a*bb(a+b)*



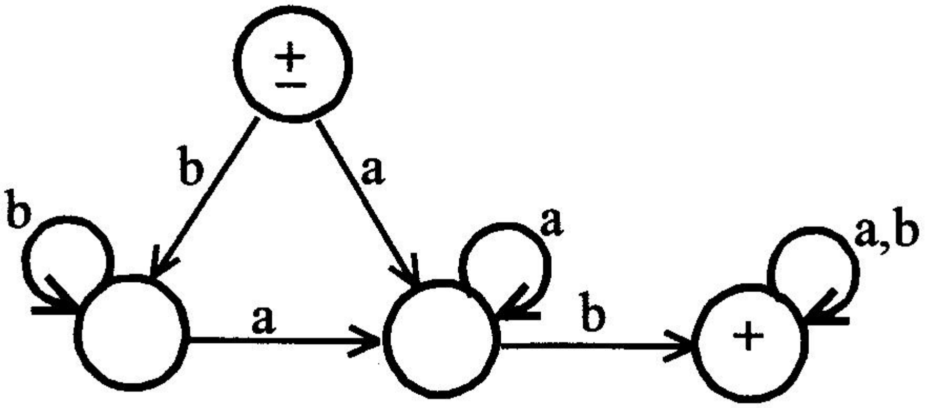
Exercises # 3 (ii) page 143



Exercises # 5(i) page 143

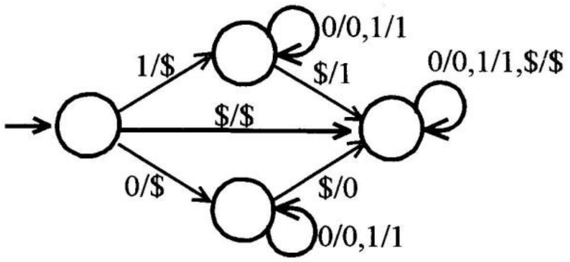


Exercise # 6 (ii) page 144



Exercise # 13 page 167

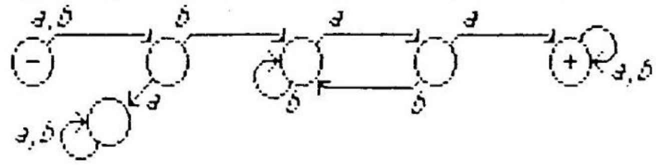
(i)



(ii) There is no way of knowing when the last letter is read and its time to print the letter that was read first.

Exercise # 5 page 185

$(\mathbf{a}+\mathbf{b})\mathbf{b}(\mathbf{a}+\mathbf{b})^*\mathbf{aa}(\mathbf{a}+\mathbf{b})^*$ **(second letter is *b*, contains *aa*)**



Exercise # 6 (i), page 204

(i) The squares have an interesting property. Consecutive squares differ by consecutive odd numbers. $1^2 = 1$ $2^2 = 1+3$ $3^2 = 1+3+5$ $4^2 = 1+3+5+7$ ...

This is because $(n+1)^2 - (n)^2 = 2n+1$ (an odd number.)
So the gaps between the squares grows larger and larger. For any number M eventually no two squares will differ by M. Certainly if $x > M$ and $y > M$ then $x^2-y^2 > M$ (unless x=y) since the closest they would be is $(M+1)^2-M^2 = 2M+1 > M$.
So when we pump, let $s = n^2$, $a^s = xyz = a^p a^q a^r$, the Pumping Lemma says that *xyz, xyyz, xyyyz*, ... are all in $\mathbf{a}^s$, which are a^{p+r+q}, a^{p+r+2q} , a^{p+r+3q}, ... However, in this sequence consecutive terms differ by the constant *q*, while squares get further and further apart. Therefore these terms can not all be squares.

Exercise # 17 page 205

(i) By Theorem 5, any finite set of words is a regular language. By Theorem 10, the set of regular languages is closed under union, so the addition of a finite ser of words to a regular language yields a regular language.

(ii) The difference between two sets is the intersection of the first with the complement of the second. Since any finite set of words is a regular language its complement is regular. By Theorem 12, the intersection of two regular languages is regular.

(iii), (iv) if *nonregular* + *finite* = *regular* then *regular* - *finite* = *nonregular* (in short hand) and we know the latter to be false, hence the antecedent is false. So if a language is nonregular, adding or eliminating a few words does not effect its "regularity".

Exercise # 18 page 221

Follow the *a*-edge out of the original start state and paint its destination state blue. From this point (instead of from the original start state) follow the blue paint procedure of the chapter.