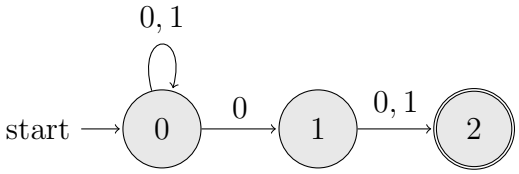
Answer the following questions to the best of your ability. Your answers should be both thorough and complete. Do your own work. Good luck!

NAME _____

1. (5 points) Draw an NFA that accepts the binary language whose every string has a 0 as the penultimate (second to last) character.

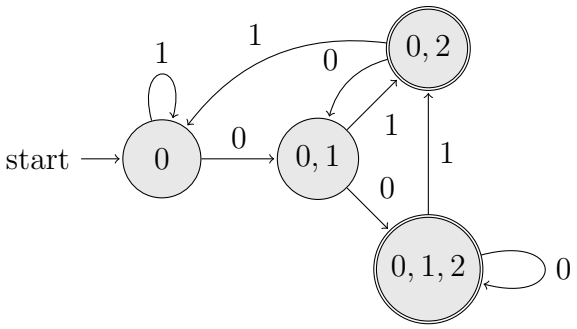
Solution:



2. (5 points) Convert the NFA from question 1 into a DFA. Be sure to show your work.

Solution:

	0	1
$\Rightarrow \{0\}$	$\{0,1\}$	$\{0\}$
$\{0,1\}$	$\{0,1,2\}$	$\{0,2\}$
$*\{0,2\}$	$\{0,1\}$	$\{0\}$
$*\{0,1,2\}$	$\{0,1,2\}$	$\{0,2\}$



3. (5 points) Write out a regular expression for the binary language where each string is non-empty and starts and ends with the same character.

Solution:

$$\mathbf{0} + \mathbf{1} + \mathbf{0}(\mathbf{0} + \mathbf{1})^*\mathbf{0} + \mathbf{1}(\mathbf{0} + \mathbf{1})^*\mathbf{1}$$

The special cases of length 1 strings need to be taken separately. Then the other two cases are separated as well.

4. (5 points) Below is a regular expression over the genetic alphabet $\{G, A, T, C\}$,

$$(\mathbf{G}^*\mathbf{A}^*\mathbf{T}^*\mathbf{C}^*)^*\mathbf{TACT}(\mathbf{G}+\mathbf{A}+\mathbf{T}+\mathbf{C})^*.$$

Write out a brief English language description of the language captured by this expression.

Solution: Any string that contains the substring $TACT$.