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Q. 2.47

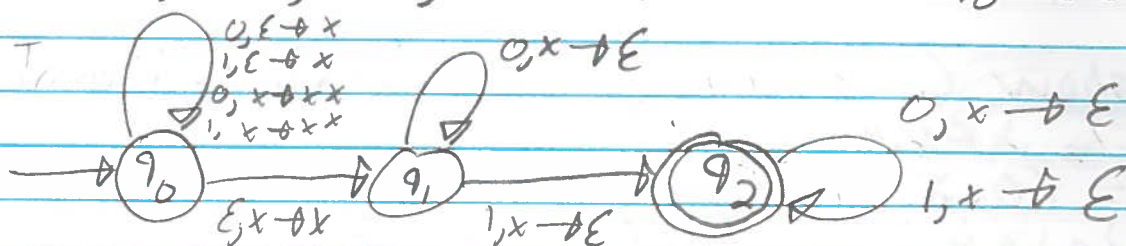
Let $\Sigma = \{0, 1\}$, let B be the collection of strings that contain at least 1 1 in the second half

$$B = \{uv \mid u \in \Sigma^*, v \in \Sigma^* \mid \Sigma^* \text{ and } |u| \geq |v|\}$$

a. Give a PDA that recognizes B

Let $M = (Q, \Sigma, \Gamma, \delta, q_0, F)$

$Q = \{q_0, q_1, q_2, q_3\}$, $\Gamma = \{x\}$, $F = \{q_3\}$ $q_0 = \{q_0\}$



b. CFG for B

$S \rightarrow UV$

$U \rightarrow AB$

$V \rightarrow A1A \mid A1B \mid A1U \mid B1U \mid U1U$

$A \rightarrow \epsilon \mid 00^*$

$B \rightarrow \epsilon \mid 11^*$

Makes sure the second half has at least one 1

A inserts at least one zero or empty