

Homework #4

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3.1a)

string: 0

$q_1 0$

$\sqcup q_2 \sqcup$

$\sqcup \sqcup q_{accept}$

3.1c)

string: 000

$q_1 000$

$\sqcup q_2 00$

$\sqcup x q_3 0$

$\sqcup x 0 q_4$

$\sqcup x 0 \sqcup q_{reject}$

3.1d)

string: 000000

$q_1 000000$

$\sqcup q_2 00000$

$\sqcup x q_3 0000$

$\sqcup x 0 q_4 000$

$\sqcup x 0 x q_3 00$

$\sqcup x 0 x 0 q_4 0$

$\sqcup x 0 x 0 x q_3 \sqcup$

$\sqcup x 0 x 0 q_5 x \sqcup$

$\sqcup x 0 x q_5 0 x \sqcup$

$\sqcup x 0 q_5 x o x \sqcup$

$\sqcup x q_5 0 x 0 x \sqcup$

$\sqcup q_5 x 0 x 0 x \sqcup$

$q_5 \sqcup x0x0x \sqcup$
 $\sqcup q_2x0x0x \sqcup$
 $\sqcup xq_20x0x \sqcup$
 $\sqcup xxq_3x0x \sqcup$
 $\sqcup xxxq_30x \sqcup$
 $\sqcup xxx0q_4x \sqcup$
 $\sqcup xxx0xq_4 \sqcup$
 $\sqcup xxx0x \sqcup q_{reject}$

3.1extra)
 string: 00000000
 $q_10000000$
 $\sqcup q_20000000$
 $\sqcup xq_3000000$
 $\sqcup x0q_400000$
 $\sqcup x0xq_30000$
 $\sqcup x0x0q_4000$
 $\sqcup x0x0xq_300$
 $\sqcup x0x0x0q_40$
 $\sqcup x0x0x0xq_3 \sqcup$
 $\sqcup x0x0x0q_5x \sqcup$
 $\sqcup x0x0xq_50x \sqcup$
 $\sqcup x0x0q_5x0x \sqcup$
 $\sqcup x0xq_50x0x \sqcup$
 $\sqcup x0q_5x0x0x \sqcup$
 $\sqcup xq_50x0x0x \sqcup$
 $\sqcup q_5x0x0x0x \sqcup$
 $q_5 \sqcup x0x0x0x \sqcup$
 $\sqcup q_2x0x0x0x \sqcup$
 $\sqcup xq_20x0x0x \sqcup$
 $\sqcup xxq_3x0x0x \sqcup$
 $\sqcup xxxq_30x0x \sqcup$
 $\sqcup xxx0q_4x0x \sqcup$
 $\sqcup xxx0xq_40x \sqcup$
 $\sqcup xxx0xxq_3x \sqcup$
 $\sqcup xxx0xxxq_3 \sqcup$
 $\sqcup xxx0xxq_5x \sqcup$
 $\sqcup xxx0xq_5xx \sqcup$
 $\sqcup xxx0q_5xxx \sqcup$

$\sqcup xxxq_5 0xxx \sqcup$
 $\sqcup xxq_5 x 0xxx \sqcup$
 $\sqcup xq_5 xx 0xxx \sqcup$
 $\sqcup q_5 xxx 0xxx \sqcup$
 $q_5 \sqcup xxx 0xxx \sqcup$
 $\sqcup q_2 xxx 0xxx \sqcup$
 $\sqcup xq_2 xx 0xxx \sqcup$
 $\sqcup xxq_2 x 0xxx \sqcup$
 $\sqcup xxxq_2 0xxx \sqcup$
 $\sqcup xxxxxq_3 xxx \sqcup$
 $\sqcup xxxxxxq_3 xx \sqcup$
 $\sqcup xxxxxxxq_3 x \sqcup$
 $\sqcup xxxxxxxq_5 x \sqcup$
 $\sqcup xxxxxxq_5 xx \sqcup$
 $\sqcup xxxxxq_5 xxx \sqcup$
 $\sqcup xxxq_5 xxxxx \sqcup$
 $\sqcup xxq_5 xxxxxx \sqcup$
 $\sqcup xq_5 xxxxxx \sqcup$
 $\sqcup q_5 xxxxxxx \sqcup$
 $q_5 \sqcup xxxxxxx \sqcup$
 $\sqcup q_2 xxxxxxx \sqcup$
 $\sqcup xq_2 xxxxxx \sqcup$
 $\sqcup xxq_2 xxxxxx \sqcup$
 $\sqcup xxxq_2 xxxxx \sqcup$
 $\sqcup xxxxxq_2 xxx \sqcup$
 $\sqcup xxxxxxq_2 xx \sqcup$
 $\sqcup xxxxxxxq_2 x \sqcup$
 $\sqcup xxxxxxxq_2 \sqcup$
 $\sqcup xxxxxxx \sqcup q_{accept}$

3.2b)
 string: 1#1
 $q_1 1 \# 1$
 $xq_3 \# 1$
 $x \# q_5 1$
 $xq_6 \# x$
 $q_7 x \# x$
 $xq_1 \# x$
 $x \# q_8 x$

$x \# xq_8$
 $x \# xq_8 \sqcup$
 $x \# x \sqcup q_{accept}$

3.2c)
 string: 1##1
 $q_1 1 \# \# 1$
 $xq_3 \# \# 1$
 $x \# q_5 \# 1$
 $x \# \# q_{reject} 1$

3.2d)
 string: 10#11
 $q_1 10 \# 11$
 $xq_3 0 \# 11$
 $x0q_3 \# 11$
 $x0 \# q_5 11$
 $x0q_6 \# x1$
 $xq_7 0 \# x1$
 $q_7 x0 \# x1$
 $xq_1 0 \# x1$
 $xxq_2 \# x1$
 $xx \# q_4 x1$
 $xx \# xq_4 1$
 $xx \# x1 q_{reject}$

3.2extra1)
 string: 01100#01100
 $q_1 01100 \# 01100$
 $xq_2 1100 \# 01100$
 $x1q_2 100 \# 01100$
 $x11q_2 00 \# 01100$
 $x110q_2 0 \# 01100$
 $x1100q_2 \# 01100$
 $x1100 \# q_4 01100$
 $x1100q_6 \# x1100$
 $x110q_7 0 \# x1100$

$x11q_700\#x1100$
 $x1q_7100\#x1100$
 $xq_71100\#x1100$
 $q_7x1100\#x1100$
 $xq_11100\#x1100$
 $xxq_3100\#x1100$
 $xx1q_300\#x1100$
 $xx10q_30\#x1100$
 $xx100q_3\#x1100$
 $xx100\#q_5x1100$
 $xx100\#xq_51100$
 $xx100\#q_6xx100$
 $xx100q_6\#xx100$
 $xx10q_70\#xx100$
 $xx1q_700\#xx100$
 $xxq_7100\#xx100$
 $xq_7x100\#xx100$
 $xxq_1100\#xx100$
 $xxxq_300\#xx100$
 $xxx0q_30\#xx100$
 $xxx00q_3\#xx100$
 $xxx00\#q_5xx100$
 $xxx00\#xq_5x100$
 $xxx00\#xxq_5100$
 $xxx00\#xq_6xx00$
 $xxx00\#q_6xxx00$
 $xxx00q_6\#xxx00$
 $xxx0q_70\#xxx00$
 $xxxq_700\#xxx00$
 $xxq_7x00\#xxx00$
 $xxxq_100\#xxx00$
 $xxxxq_20\#xxx00$
 $xxxx0q_2\#xxx00$
 $xxxx0\#q_4xxx00$
 $xxxx0\#xq_4xx00$
 $xxxx0\#xxq_4x00$
 $xxxx0\#xxxq_400$
 $xxxx0\#xxq_6xx0$
 $xxxx0\#xq_6xxx0$
 $xxxx0\#q_6xxxx0$

$xxxx0q_6\#xxxx0$
 $xxxxq_70\#xxxx0$
 $xxxq_7x0\#xxxx0$
 $xxxxq_10\#xxxx0$
 $xxxxxq_2\#xxxx0$
 $xxxxx\#q_4xxxx0$
 $xxxxx\#xq_4xxx0$
 $xxxxx\#xxq_4xx0$
 $xxxxx\#xxxq_4x0$
 $xxxxx\#xxxxq_40$
 $xxxxx\#xxxq_6xx$
 $xxxxx\#xxq_6xxx$
 $xxxxx\#xq_6xxxx$
 $xxxxx\#q_6xxxxx$
 $xxxxxq_6\#xxxxx$
 $xxxxq_7x\#xxxxx$
 $xxxxxq_1\#xxxxx$
 $xxxxx\#q_8xxxxx$
 $xxxxx\#xq_8xxxx$
 $xxxxx\#xxq_8xxx$
 $xxxxx\#xxxq_8xx$
 $xxxxx\#xxxxq_8x$
 $xxxxx\#xxxxxq_8$
 $xxxxx\#xxxxxq_8\sqcup$
 $xxxxx\#xxxxx\sqcup q_{accept}$

3.2extra2)
 string: 01101#01100
 $q_101101\#01100$
 $xq_21101\#01100$
 $x1q_2101\#01100$
 $x11q_201\#01100$
 $x110q_21\#01100$
 $x1101q_2\#01100$
 $x1101\#q_401100$
 $x1101q_6\#x1100$
 $x110q_71\#x1100$
 $x11q_701\#x1100$
 $x1q_7101\#x1100$
 $xq_71101\#x1100$

$q_7x1101\#x1100$
 $xq_11101\#x1100$
 $xxq_3101\#x1100$
 $xx1q_301\#x1100$
 $xx10q_31\#x1100$
 $xx101q_3\#x1100$
 $xx101\#q_5x1100$
 $xx101\#xq_51100$
 $xx101\#q_6xx100$
 $xx101q_6\#xx100$
 $xx10q_71\#xx100$
 $xx1q_701\#xx100$
 $xxq_7101\#xx100$
 $xq_7x101\#xx100$
 $xxq_1101\#xx100$
 $xxxq_301\#xx100$
 $xxx0q_31\#xx100$
 $xxx01q_3\#xx100$
 $xxx01\#q_5xx100$
 $xxx01\#xq_5x100$
 $xxx01\#xxq_5100$
 $xxx01\#xq_6xx00$
 $xxx01\#q_6xxx00$
 $xxx01q_6\#xxx00$
 $xxx0q_71\#xxx00$
 $xxxq_701\#xxx00$
 $xxq_7x01\#xxx00$
 $xxxq_101\#xxx00$
 $xxxxq_21\#xxx00$
 $xxxx1q_2\#xxx00$
 $xxxx1\#q_4xxx00$
 $xxxx1\#xq_4xx00$
 $xxxx1\#xxq_4x00$
 $xxxx1\#xxq_6xx0$
 $xxxx1\#xq_6xxx0$
 $xxxx1\#q_6xxxx0$
 $xxxx1q_6\#xxxx0$
 $xxxxq_71\#xxxx0$
 $xxxq_7x1\#xxxx0$
 $xxxxq_11\#xxxx0$

$xxxxxq_3\#xxx0$
 $xxxxx\#q_5xxx0$
 $xxxxx\#xq_5xxx0$
 $xxxxx\#xxq_5xx0$
 $xxxxx\#xxxq_5x0$
 $xxxxx\#xxxxq_50$
 $xxxxx\#xxxxq_{reject}0$

3.8b)

1. Read the tape for a '1' and mark it. If there are no 1's, go to step 5. Otherwise, the head is at the start of the tape.
2. Read the tape for a '0' and mark it. If there are no 0's, reject.
3. Read the tape for a '0' again and mark it. If there are no 0's, reject.
4. Loop back to the front of the tape and repeat stage 1.
5. Loop back to the front of the tape and read it for a '0'. If there are not any, accept. Otherwise, reject.

3.8c)

1. Read the tape for a '1' and mark it. If there are no 1's, go to step 5. Otherwise, the head is at the start of the tape.
2. Read the tape for a '0' and mark it. If there are no 0's, accept. Otherwise, reject.
3. Read the tape for a '0' and mark it. If there are no 0's, accept. Otherwise, reject.
4. Loop back to the front of the tape and repeat stage 1.
5. Loop back to the front of the tape and read it for a '0'. If there are not any, reject. Otherwise, accept.