Homework 9

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Problem 1

In the beginning, We suppose that an instantaneous description in the Turing Machine shouldn't have the b(blank) at the each end of the sequence.

Let we give a production that captures a left move.In a normal situation, the move function is $\delta(q_i, y) = \{q_j, z, L\}$, so we have $uxq_iyv \vdash vzxq_ju(x, y, z \in \{0, 1, b\}, u, v \in \{0, 1\}^*)$ in the problem.

Easily, we construct a cfg for the production below.

$$S \longrightarrow 1A1 \mid 0A0 \mid C$$

$$C \longrightarrow 0q_iyBz0q_j \mid 1q_iyBz1q_j$$

$$A \longrightarrow xq_iyBzxq_j \mid uxq_i \vdash zxq_ju$$

$$B \longrightarrow 0B0 \mid 1B1 \mid \vdash$$

The special situation of this problem is that $x = b \text{or} y = b$. It's easy to know x should not be b(blank). So, we just consider $y = b$ is enough.

Similarly, we give a production that captures a right move.In a normal situation, the move function is $\delta(q_i, y) = \{q_j, z, R\}$, so we have $uxq_iyv \vdash vq_jzxu$ in the problem.

Obviously, we construct a cfg for the production below.

$$S \longrightarrow 1A1 \mid 0A0 \mid A$$

$$A \longrightarrow q_iyBq_jz \mid q_i \vdash q_jz$$

$$B \longrightarrow 1B1 \mid 0B0 \mid \vdash$$

As we can see, the special situation of this problem is that the head q is at the right end of the sequence.