

CS5230. Tutorial 2: Answer Sketches

Q1. Follows from a result to be done later in lectures. Main idea is to construct a machine which does a diagonalization against all 2-tape TMs (one input tape and one work tape), which use alphabet $\{0, 1, B\}$.

Q2.

Initially:

...	E	E	E	E	E	E	E	E	*	E	E	E	E	E	E	E	E	...
...	c8	c7	c6	c5	c4	c3	c2	c1	b0	b1	b2	b3	b4	b5	b6	b7	b8	...

After 1 step:

...	E	E	E	E	E	E	E	c1	*	E	E	E	E	E	E	E	E	...
...	c8	c7	c6	c5	c4	c3	c2	b0	b1	E	b2	b3	b4	b5	b6	b7	b8	...

After 2 steps:

...	E	E	E	E	E	c3	c1	E	*	E	E	E	E	E	E	E	E	...
...	c8	c7	c6	c5	c4	c2	b0	b1	b2	b3	E	E	b4	b5	b6	b7	b8	...

After 3 steps:

...	E	E	E	E	E	c3	c1	b1	*	E	E	E	E	E	E	E	E	...
...	c8	c7	c6	c5	c4	c2	b0	b2	b3	E	E	E	b4	b5	b6	b7	b8	...

After 4 steps:

...	E	c7	c5	c3	c1	E	E	E	*	E	E	E	E	E	E	E	E	...
...	c8	c6	c4	c2	b0	b1	b2	b3	b4	b5	b6	b7	E	E	E	E	b8	...

Q3. Follows from a result to be done later in lectures. Main idea is to construct a machine which does a diagonalization against all 2-tape TMs, which use alphabet $\{0, 1, B\}$.

Q4. Suppose $L \in NPSPACE$. Then, for some polynomial p , $L \in NPSPACE(p(n))$. Thus, by Savitch's theorem, $L \in DSPACE((p(n))^2) \subseteq PSPACE$. Hence we have that $NPSPACE \subseteq PSPACE$. As, $PSPACE \subseteq NPSPACE$ by definition, we have $PSPACE = NPSPACE$.

Q5. We know how to reuse space, but not time. This is the main reason why the simulations we did for (nondeterministic) space, do not carry over to time.