INT201 Decision, Computation and Language

Tutorial 8

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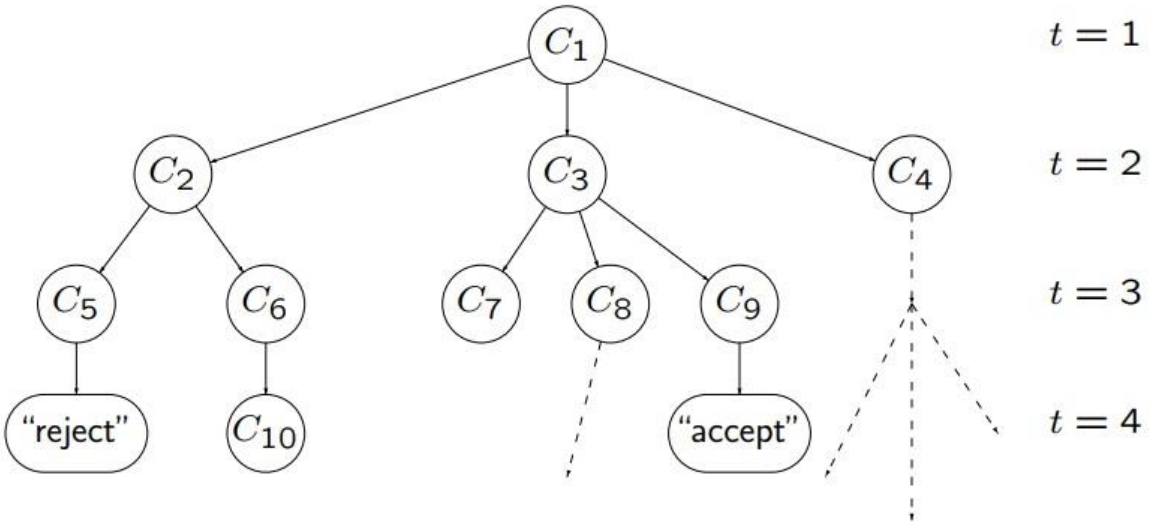
1. With any input w, computation of the given NTM is represented by a configuration tree as below:



(1) What is the address of "accept" configuration?

(2) What is the address of configuration C_6 ?

(3) What is the address of configuration C_1 ?

(4) What's the meaning of address 132 ?

2. Give an implementation-level description of a Turing machine that decides the language $B = \{ 0^n1^n2^n \mid n \geq 0 \}$.

3. Answer the following questions (and justify your answers):

(1) Can a Turing machine ever write the blank symbol ␣ on its tape?

(2) Can the tape alphabet Γ be equal to the input alphabet Σ?

(3) Can the head of a Turing machine ever stay on the same cell for two subsequent steps of a computation?

Solution

1.

(1) "accept" configuration has address 231

(2) Configuration C_6 has address 12.

(3) Configuration C_1 has address ε.

(4) Address 132 is meaningless.

2.

M = "On input string w:

1. Scan the input from left to right to make sure that it is a member of $0^*1^*2^*$, and **reject** if it isn't.
2. Return tape head to left-hand end of tape.
3. Repeat the following until no more 0s left on tape.
4. Replace the leftmost 0 with x.
5. Scan right until a 1 occurs. If there are no 1s, **reject**.
6. Replace the leftmost 1 with x.
7. Scan right until a 2 occurs. If there are no 2s, **reject**.
8. Replace the leftmost 2 with x.
9. Return tape head to left-hand end of tape, and go to stage 3.
10. If the tape contains any 1s or 2s, reject. Otherwise, **accept**."

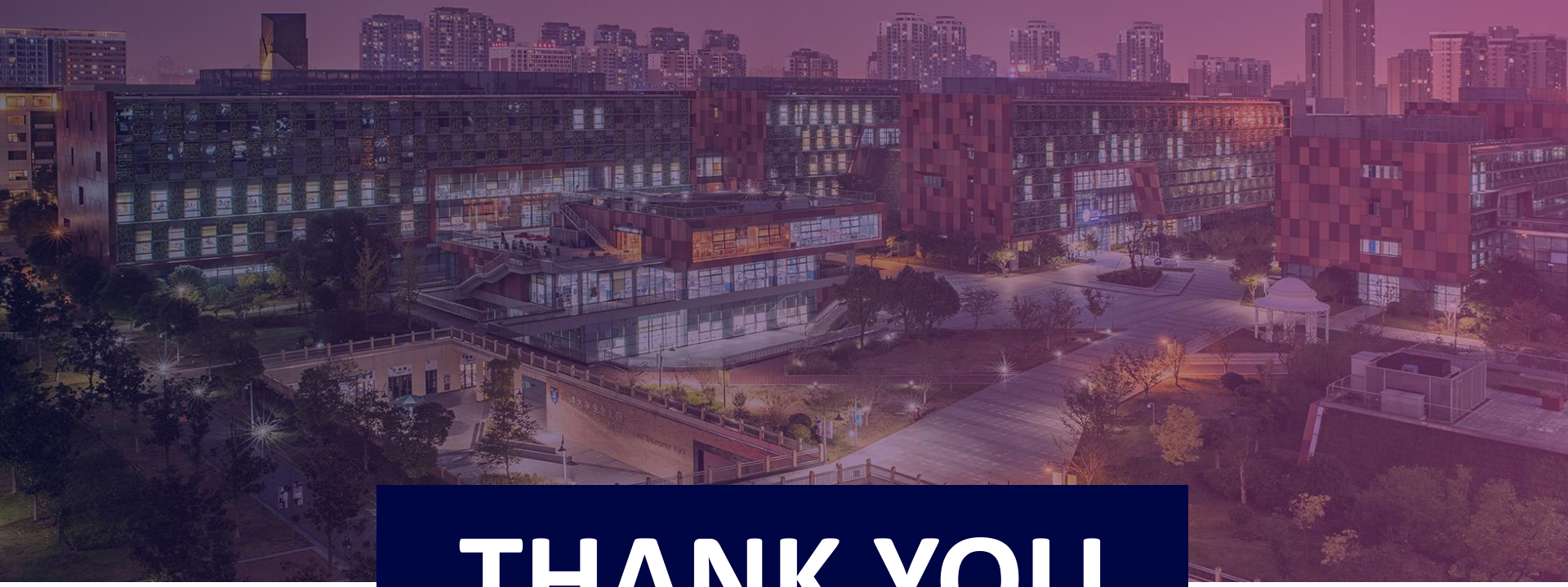
Solution

3.

(1) A Turing machine can write a $\sqcup$, since $\sqcup \in \Gamma$ and the transition function has type $\delta : Q \times \Gamma \to Q \times \Gamma \times \{L, R\}$

(2) The tape alphabet Γ can never be equal to the input alphabet Σ, since $\sqcup \in \Gamma$, whereas $\sqcup \notin \Sigma$.

(3) The head of a Turing machine can stay on the same cell for two consecutive steps of a computation if the head is at the leftmost tape cell and the machine tries to move left.



THANK YOU

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