Problem

Let CNF_H = { $\langle\phi\rangle|\ \phi$ is a satisfiable cnf-formula where each clause contains any number of literals, but at most one negated literal}. Problem 7.25 asked you to show that CNF_H ? P. Now give a log-space reduction from *CIRCUIT VALUE* to CNF_H to conclude that CNF_H is P-complete.

Step-by-step solution

Step 1 of 4

Consider the following CNF_H statement:

$CNF_H = \{<\varnothing>|\varnothing$ is a satisfiable cnf-formula, where every clause consists any number of literals, but is consists maximum one negated literals $\}$

It is known that $\mathbf{CNF_H \in P}$.

Comment

Step 2 of 4

Now, consider the **circuit evaluation** $CIRCUIT-VALUE$. For a circuit C and input string w, the value of C on w can be written as $C(w)$. Then, $CIRCUIT-VALUE$ is given by

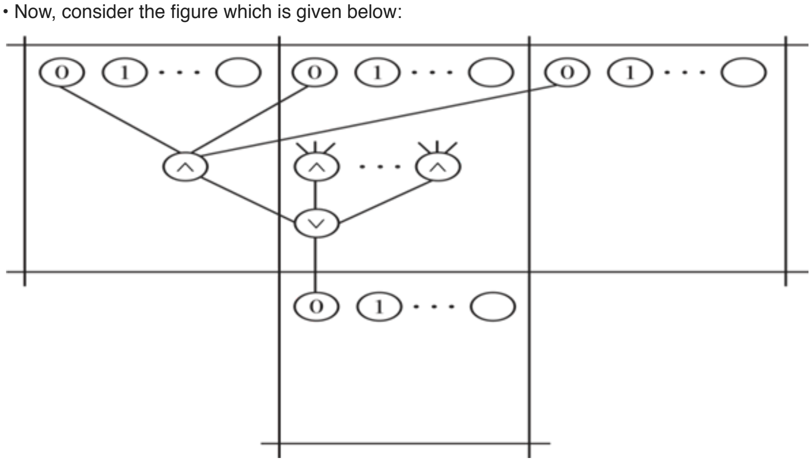
$CIRCUIT-VALUE = \{\langle C,x\rangle \mid C\,is\,a\,Boolean\,circuit\,and\,C(x)=1\}$

Comment

Step 3 of 4

Consider the given theorem, which says that "**suppose** $t:M\rightarrow M$ **be a function, where** $t(m)\geq m$. **If** $W\in TIME(t(m))$**, then the complexity of the circuit** A **is given by** $O(t^2(m))$

• Now, consider the figure which is given below:



• The above figure shows the construction of the theorem, which is discussed above. It shows the way of **reduction of a language** W **(which is in** P**)** to $CIRCUIT-VALUE$.

• On input w, the production of a circuit takes place by the reduction. The process reduction simulates the Turing machine for W in polynomial time. The w itself can be taken as an input to the circuit.

• **A log-space is used to carry out the reduction because** the circuit produced by it contains a repetitive and a simple structure. **It shows that "** $CIRCUIT-VALUE$ **is** P**-complete.**

Comment

Step 4 of 4

The above explanation **gives a log-space reduction from** $CIRCUIT - VALUE$ to CNF_H. Hence, from the above discussion it can be concluded that " $\mathbf{CNF_H}$ **is P - complete**".

Comment