# Problem #1

**Max Root of the Tree:**

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| --- |
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|  |

**Min Level one of the Tree Root of the Tree:**

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| --- |
|  |
|  |
|  |

# Problem #2

**Question: The pigeonhole principle says any function from pigeons into holes must result in two pigeons in the same hole. Let be a variable expressing that pigeon gets mapped to hole . Consider the case.**

**Express the following as propositional formulas:**

1. **Every gets mapped to some .**
2. **Some  is mapped to by  and  where .**

**The conjunction of these two statements is a propositional formula for . Convert  to clausal form and give a resolution refutation for this statement. Finally, trace the execution of DPLL on this formula.**

Part A:

Part B:

:

:

Part A:

Part B:

(!P11+!P21+!P31+!P41+P12+P13+P22+P23+P32+P33+P42+P43)

&(!P11+!P21+!P31+!P42+P12+P13+P22+P23+P32+P33+P41+P43)

&(!P11+!P21+!P31+!P43+P12+P13+P22+P23+P32+P33+P41+P42)

&(!P11+!P21+!P32+!P41+P12+P13+P22+P23+P31+P33+P42+P43)

&(!P11+!P21+!P32+!P42+P12+P13+P22+P23+P31+P33+P41+P43)

&(!P11+!P21+!P32+!P43+P12+P13+P22+P23+P31+P33+P41+P42)

&(!P11+!P21+!P33+!P41+P12+P13+P22+P23+P31+P32+P42+P43)

&(!P11+!P21+!P33+!P42+P12+P13+P22+P23+P31+P32+P41+P43)

&(!P11+!P21+!P33+!P43+P12+P13+P22+P23+P31+P32+P41+P42)

&(!P11+!P22+!P31+!P41+P12+P13+P21+P23+P32+P33+P42+P43)

&(!P11+!P22+!P31+!P42+P12+P13+P21+P23+P32+P33+P41+P43)

&(!P11+!P22+!P31+!P43+P12+P13+P21+P23+P32+P33+P41+P42)

&(!P11+!P22+!P32+!P41+P12+P13+P21+P23+P31+P33+P42+P43)

&(!P11+!P22+!P32+!P42+P12+P13+P21+P23+P31+P33+P41+P43)

&(!P11+!P22+!P32+!P43+P12+P13+P21+P23+P31+P33+P41+P42)

&(!P11+!P22+!P33+!P41+P12+P13+P21+P23+P31+P32+P42+P43)

&(!P11+!P22+!P33+!P42+P12+P13+P21+P23+P31+P32+P41+P43)

&(!P11+!P22+!P33+!P43+P12+P13+P21+P23+P31+P32+P41+P42)

&(!P11+!P23+!P31+!P41+P12+P13+P21+P22+P32+P33+P42+P43)

&(!P11+!P23+!P31+!P42+P12+P13+P21+P22+P32+P33+P41+P43)

&(!P11+!P23+!P31+!P43+P12+P13+P21+P22+P32+P33+P41+P42)

&(!P11+!P23+!P32+!P41+P12+P13+P21+P22+P31+P33+P42+P43)

&(!P11+!P23+!P32+!P42+P12+P13+P21+P22+P31+P33+P41+P43)

&(!P11+!P23+!P32+!P43+P12+P13+P21+P22+P31+P33+P41+P42)

&(!P11+!P23+!P33+!P41+P12+P13+P21+P22+P31+P32+P42+P43)

&(!P11+!P23+!P33+!P42+P12+P13+P21+P22+P31+P32+P41+P43)

&(!P11+!P23+!P33+!P43+P12+P13+P21+P22+P31+P32+P41+P42)

&(!P12+!P21+!P31+!P41+P11+P13+P22+P23+P32+P33+P42+P43)

&(!P12+!P21+!P31+!P42+P11+P13+P22+P23+P32+P33+P41+P43)

&(!P12+!P21+!P31+!P43+P11+P13+P22+P23+P32+P33+P41+P42)

&(!P12+!P21+!P32+!P41+P11+P13+P22+P23+P31+P33+P42+P43)

&(!P12+!P21+!P32+!P42+P11+P13+P22+P23+P31+P33+P41+P43)

&(!P12+!P21+!P32+!P43+P11+P13+P22+P23+P31+P33+P41+P42)

&(!P12+!P21+!P33+!P41+P11+P13+P22+P23+P31+P32+P42+P43)

&(!P12+!P21+!P33+!P42+P11+P13+P22+P23+P31+P32+P41+P43)

&(!P12+!P21+!P33+!P43+P11+P13+P22+P23+P31+P32+P41+P42)

&(!P12+!P22+!P31+!P41+P11+P13+P21+P23+P32+P33+P42+P43)

&(!P12+!P22+!P31+!P42+P11+P13+P21+P23+P32+P33+P41+P43)

&(!P12+!P22+!P31+!P43+P11+P13+P21+P23+P32+P33+P41+P42)

&(!P12+!P22+!P32+!P41+P11+P13+P21+P23+P31+P33+P42+P43)

&(!P12+!P22+!P32+!P42+P11+P13+P21+P23+P31+P33+P41+P43)

&(!P12+!P22+!P32+!P43+P11+P13+P21+P23+P31+P33+P41+P42)

&(!P12+!P22+!P33+!P41+P11+P13+P21+P23+P31+P32+P42+P43)

&(!P12+!P22+!P33+!P42+P11+P13+P21+P23+P31+P32+P41+P43)

&(!P12+!P22+!P33+!P43+P11+P13+P21+P23+P31+P32+P41+P42)

&(!P12+!P23+!P31+!P41+P11+P13+P21+P22+P32+P33+P42+P43)

&(!P12+!P23+!P31+!P42+P11+P13+P21+P22+P32+P33+P41+P43)

&(!P12+!P23+!P31+!P43+P11+P13+P21+P22+P32+P33+P41+P42)

&(!P12+!P23+!P32+!P41+P11+P13+P21+P22+P31+P33+P42+P43)

&(!P12+!P23+!P32+!P42+P11+P13+P21+P22+P31+P33+P41+P43)

&(!P12+!P23+!P32+!P43+P11+P13+P21+P22+P31+P33+P41+P42)

&(!P12+!P23+!P33+!P41+P11+P13+P21+P22+P31+P32+P42+P43)

&(!P12+!P23+!P33+!P42+P11+P13+P21+P22+P31+P32+P41+P43)

&(!P12+!P23+!P33+!P43+P11+P13+P21+P22+P31+P32+P41+P42)

&(!P13+!P21+!P31+!P41+P11+P12+P22+P23+P32+P33+P42+P43)

&(!P13+!P21+!P31+!P42+P11+P12+P22+P23+P32+P33+P41+P43)

&(!P13+!P21+!P31+!P43+P11+P12+P22+P23+P32+P33+P41+P42)

&(!P13+!P21+!P32+!P41+P11+P12+P22+P23+P31+P33+P42+P43)

&(!P13+!P21+!P32+!P42+P11+P12+P22+P23+P31+P33+P41+P43)

&(!P13+!P21+!P32+!P43+P11+P12+P22+P23+P31+P33+P41+P42)

&(!P13+!P21+!P33+!P41+P11+P12+P22+P23+P31+P32+P42+P43)

&(!P13+!P21+!P33+!P42+P11+P12+P22+P23+P31+P32+P41+P43)

&(!P13+!P21+!P33+!P43+P11+P12+P22+P23+P31+P32+P41+P42)

&(!P13+!P22+!P31+!P41+P11+P12+P21+P23+P32+P33+P42+P43)

&(!P13+!P22+!P31+!P42+P11+P12+P21+P23+P32+P33+P41+P43)

&(!P13+!P22+!P31+!P43+P11+P12+P21+P23+P32+P33+P41+P42)

&(!P13+!P22+!P32+!P41+P11+P12+P21+P23+P31+P33+P42+P43)

&(!P13+!P22+!P32+!P42+P11+P12+P21+P23+P31+P33+P41+P43)

&(!P13+!P22+!P32+!P43+P11+P12+P21+P23+P31+P33+P41+P42)

&(!P13+!P22+!P33+!P41+P11+P12+P21+P23+P31+P32+P42+P43)

&(!P13+!P22+!P33+!P42+P11+P12+P21+P23+P31+P32+P41+P43)

&(!P13+!P22+!P33+!P43+P11+P12+P21+P23+P31+P32+P41+P42)

&(!P13+!P23+!P31+!P41+P11+P12+P21+P22+P32+P33+P42+P43)

&(!P13+!P23+!P31+!P42+P11+P12+P21+P22+P32+P33+P41+P43)

&(!P13+!P23+!P31+!P43+P11+P12+P21+P22+P32+P33+P41+P42)

&(!P13+!P23+!P32+!P41+P11+P12+P21+P22+P31+P33+P42+P43)

&(!P13+!P23+!P32+!P42+P11+P12+P21+P22+P31+P33+P41+P43)

&(!P13+!P23+!P32+!P43+P11+P12+P21+P22+P31+P33+P41+P42)

&(!P13+!P23+!P33+!P41+P11+P12+P21+P22+P31+P32+P42+P43)

&(!P13+!P23+!P33+!P42+P11+P12+P21+P22+P31+P32+P41+P43)

&(!P13+!P23+!P33+!P43+P11+P12+P21+P22+P31+P32+P41+P42)