Homework 2

CS 540
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1 Consider the following block of three-address code in which a, b, and c are live at the end of the block and all other variables are dead at the end of the block.

$$
\begin{array}{|l|}
\hline
t_1 := 3 \\
t_2 := t_1 + 4 \\
t_3 := t_1 * t_2 \\
a := b[t_3] \\
t_4 := 7 \\
t_5 := t_1 * t_4 \\
c := b[t_5] \\
\hline
\end{array}
$$

Use the DAG construction algorithm to generate "optimized" three-address code. Show the DAG which is constructed, indicating the labels to be defined and the primary label at each node.

2 Consider the following flow graph.

Identify all loops and their entry nodes, designating which loops are inner loops.

3 Prove the following loop nesting theorem:

> **Theorem**. If two loops have distinct entry nodes, they are either disjoint or one is included in the other.

4 Prove the following theorem:

> **Theorem**. The entry node of a loop dominates all nodes in the loop.

5 Prove or disprove the following conjecture:

> **Conjecture**. Every loop is the natural loop of some back edge.