

# Programming Languages and Compilers (CS516) - Homework #3

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- 1 For each of the following loops, specify the nature of each loop dependency (if any).** **1**

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1. Here, the statement  $S$  defined as  $A(2i) = A(i) + 1$  has a true dependence on itself. We supply direction vector  $[<]$ , but we cannot supply a distance vector due to the inconsistency of the dependency.
2. Here, the statement  $S$  defined as  $A(2i) = A(7i) + 1$  has an anti-dependence on itself. We supply direction vector  $[<]$ , but we cannot supply a distance vector due to the inconsistency of the dependency.
3. Here, the given algorithm does not have any loop dependencies.
4. Here, the statement  $S$  defined as  $A(i) = A(10 - i) - 5$  has a true dependence on itself. We supply direction vector  $[<]$ , but we cannot supply a distance vector.
5. Here, the statement  $A(i, j) = 2A(i - 1, j + 3)$  has an anti dependence on itself. We supply distance vector  $[< \quad >]$  and direction vector  $[1 \quad -3]$ .
6. Let  $S$  be the statement  $A(i) = \dots$  and  $T$  be the statement  $\dots = A(j + 1)$ .  $T$  has a true dependence on  $S$  with direction vector  $[< \quad >]$  and distance vector  $[1 \quad -1]$ .

7. Let  $S$  be the statement  $A(i) = \dots$  and  $T$  be the statement  $\dots = A(j + i)$ .  $S$  has a loop-independent dependence on  $T$ ; thus, any direction or distance vector would be vacuous.
8. By the Theorem of Simple Dependence Testing (Lecture 15, Slides 12-13), the instruction  $A(i, j, i) = 2A(i, j+1, i-1)$  has a dependency iff there exists  $(i, j) \in I$  s.t. the following are satisfied (they clearly are not):

$$\begin{aligned}
 i &= i \\
 j &= j + 1 \\
 i &= i - 1
 \end{aligned}$$