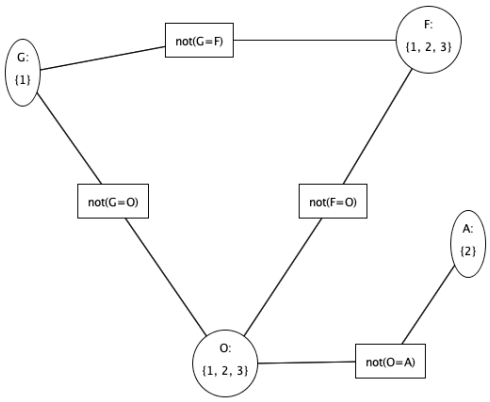
CPSC 322: Introduction to Artificial Intelligence (Section 2)
Solving CSPs using arc consistency and domain splitting
Do this exercise in pairs. If there's an odd number, do it in a group of 3.
Submit the sheet before leaving.

Name of Student (last, first)	Student Number

Question1: Arc consistency
Consider the following subset of the constraint network we worked on last week. Trace the arc consistency algorithm on the network. Show at least 4 to 6 iterations. For each iteration, show TDA and domain values.



Variables:
Google (G), Facebook (F), OpenAI (O), Apple (A)

Start
TDA =
$\{ < F, G \neq F > , < F, F \neq O > , < O, G \neq O > , < O, F \neq O > , < O, O \neq A > , < A, O \neq A > , < G, G \neq F > , < G, G \neq O > \}$
Domains: G = {1}; F = {1,2,3}; O = {1,2,3}; A = {2}

Iteration 1
Select arc <F, not(G = F)>
TDA =
$\{ < F, F \neq O > , < O, G \neq O > , < O, F \neq O > , < O, O \neq A > , < A, O \neq A > , < G, G \neq F > , < G, G \neq O > \}$

Check <F, not(G = F)> for consistency.
1 removed from the domain of F to make arc <F, not(G=F)> consistent.
New domains: G = {1}; F = {2,3}; O = {1,2,3}; A = {2}
Affected arcs due to domain pruning: <O, not(F=O)>
Not adding the affected arcs in TDA because they are already there.

Iteration 2
Select arc <F, not(F = O)>
TDA =
$\{ < O, G \neq O > , < O, F \neq O > , < O, O \neq A > , < A, O \neq A > , < G, G \neq F > , < G, G \neq O > \}$
Check <F, not(F = O)> for consistency.
The arc is consistent and the domains do not change.
Domains: G = {1}; F = {2,3}; O = {1,2,3}; A = {2}

Iteration 3
Select arc <O, not(G=O)>
TDA =$\{ < O, F \neq O > , < O, O \neq A > , < A, O \neq A > , < G, G \neq F > , < G, G \neq O > \}$
Check <O, not(G = O)> for consistency.
1 removed from the domain of O to make arc <O, not(G=O)> consistent.
New domains: G = {1}; F = {2,3}; O = {2,3}; A = {2}
Affected arcs due to domain pruning: <F, not(F=O) >, <A, not(O=A)>

TDA=
$\{ < O, F \neq O > , < O, O \neq A > , < A, O \neq A > , < G, G \neq F > , < G, G \neq O > , < F, F \neq O > \}$

Iteration 4
Select <O, not(F=O)>
TDA = $\{ < O, O \neq A > , < A, O \neq A > , < G, G \neq F > , < G, G \neq O > , < F, F \neq O > \}$
Check <O, not(F=O)> for consistency.
The arc is consistent and the domains do not change.
Domains: G = {1}; F = {2,3}; O = {2,3}; A = {2}

Iteration 5
Select <O, not(O=A)>
TDA = $\{ < A, O \neq A > , < G, G \neq F > , < G, G \neq O > , < F, F \neq O > \}$
Check <O, not(O=A)> for consistency.
2 removed from the domain of O to make arc <O, not(O=A)> consistent.
New domains: G = {1}; F = {2,3}; O = {3}; A = {2}
Affected arcs due to domain pruning: <F, not(F=O)>, <G, not(G=O)>
Arcs are already on TDA so not adding them.

…. continue till you get an arc-consistent network

Question 2: Domain splitting

Variables: A, B, C; Domains: {1,2,3,4}; Constraints:$A = B, B = C, A = C$

Solve this CSP using arc consistency and domain splitting. How many solutions are there?