Assignment 1

Due Date: 3/10/2023

Time: 23.55

Please note:

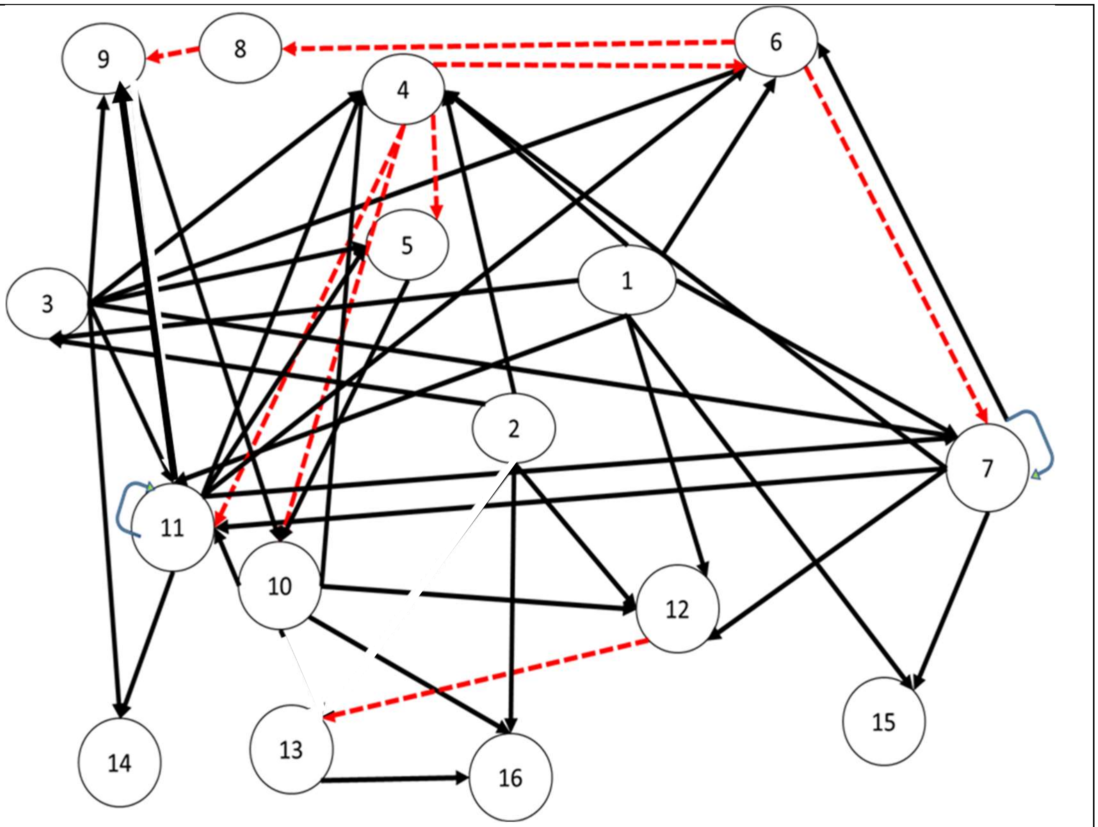
This is an individual assignment

No late submissions are accepted.

QUESTION #1 STATIC BACKWARD SLICING

A. Create a static PDG for the program below

```
1.CIN >> B;
2.CIN >> X;
3.A=X+B;
4.WHILE (A<(X+B))
{
5.X=A;
6.IF (A>B)
   {
7.    B=10+A+B;
   }
8.  ELSE
     {
9.      X= A-1;
      }
10.  X--;
11.  A=A-B-X;
     }
12.        IF (B < X)
{
13.           X=10;
}
14.        COUT <<A;
15.        COUT <<B;
16.        COUT <<X;
```



B.)

Compute a static slice for the following variables. Hint: Use the PDG from A.)

Compute Slice (B,15)= {1,2,3,4,5,6, 7,8,9,10,11,15 }

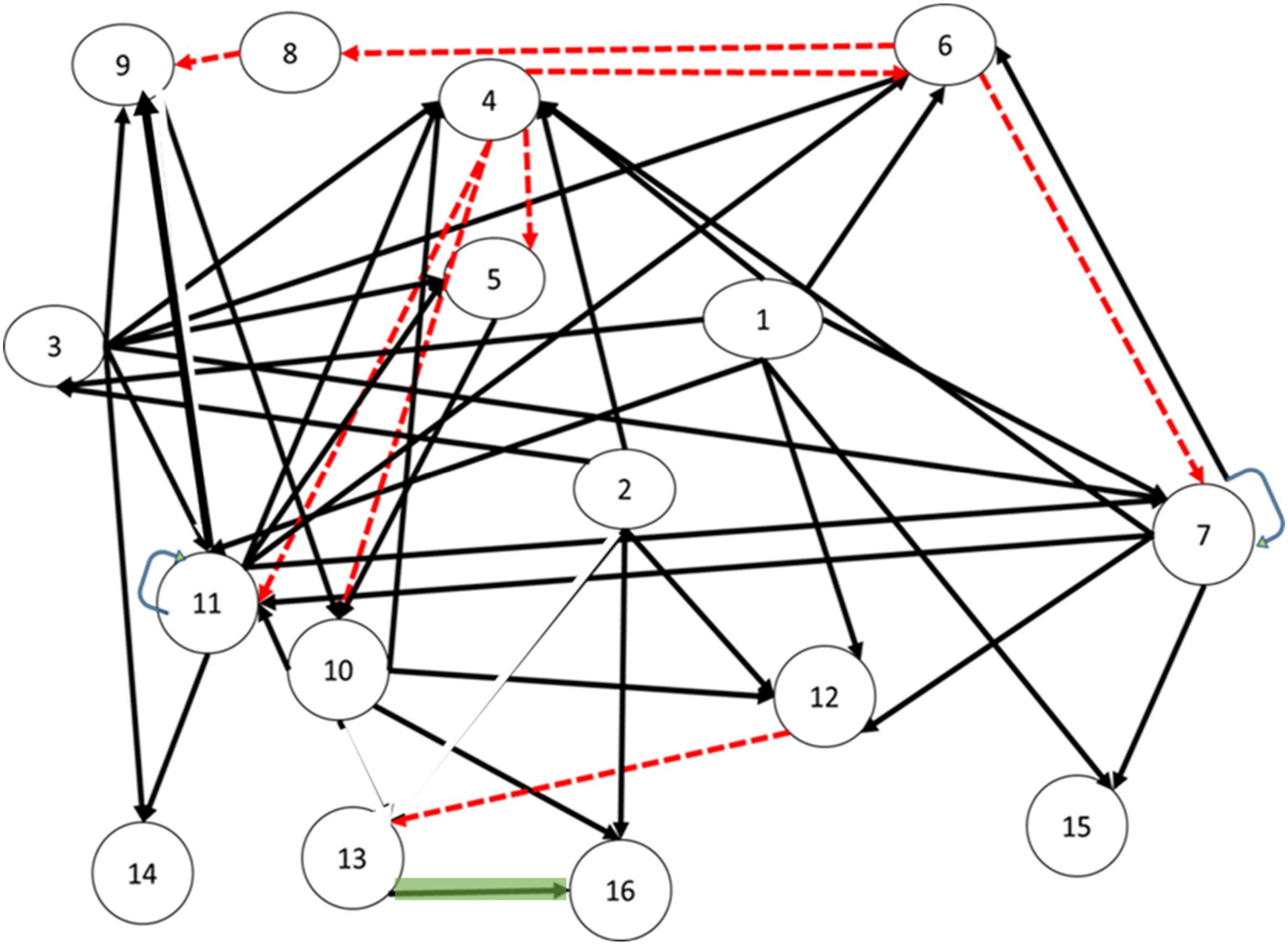
Compute Slice S(X,16) = {1,2,3,4,5,6,7,8,9,10,11,12,13,16 }

c)

Compute a **static forward slice for** statement 9 => Static slice S(9) ={ 4,5,6,7,8,9,10,11,12,13,14,16 }

Compute **a static forward slice for** statement 13 => Static slice s(13) ={ 13,16 }

Hint: There is no need to create a new PDG, you can reuse the one from question A) – The PDG is just for illustration purposes.



QUESTION #2

PLEASE USE THE PROGRAM SHOWN ON THE LEFT AND COMPLETE THE PROGRAM DEPENDENCIES IN THE TABLE– FOLLOWING THE EXAMPLE PROVIDED BELOW –

```
1.   Y =10
2.   IF (Y)
3.        Y=Y+1;
```

	Is **data** dependent on			
		1	2	3
Node	1			
	2	X		
	3	X		

	Is **control** dependent on			
		1	2	3
Node	1			
	2			
	3		X	

```
1.  CIN >> B;
2.  CIN >> X;
3.  A=X+B;
4.  WHILE (A<(X+B))
    {
5.      X=B+X;
6.      IF (A>(B+C))
        {
7.          B=10+A+B;
        }
8.      ELSE
        {
9.          X= 10;
        }
10.  X--;
11.  A=A-B-X;
     }
12.COUT <<A;
13. COUT <<B;
14. COUT <<X;
```

Data Dependencies

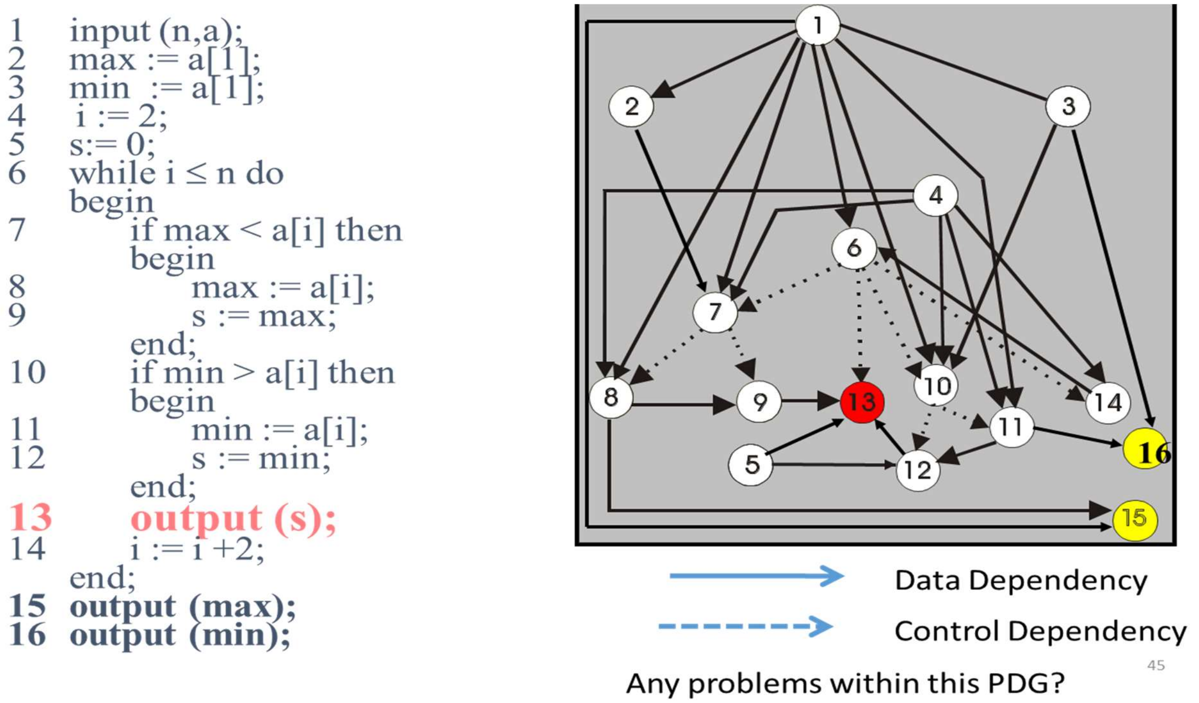
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Node	1														
	2														
	3	X	X												
	4	X	X	X				X			X	X			
	5	X	X					X			X				
	6	X		X				X				X			
	7	X		X				X				X			
	8														
	9														
	10					X				X					
	11	X		X				X			X	X			
	12			X								X			
	13	X						X							
	14		X								X				

Control Dependencies

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Node	1														
	2														
	3														
	4														
	5				X										
	6				X										
	7						X								
	8						X								
	9								X						
	10				X										
	11				X										
	12														
	13														
	14														

Question #3

Given is the following program and PDG – identify all the problems in this PDG (wrong/missing dependencies)



```
1   input (n,a);
2   max := a[1];
3   min  := a[1];
4    i := 2;
5   s:= 0;
6   while i ≤ n do
    begin
7         if max < a[i] then
          begin
8               max := a[i];
9               s := max;
          end;
10        if min > a[i] then
          begin
11              min := a[i];
12              s := min;
          end;
13        output (s);
14        i := i +2;
    end;
15  output (max);
16  output (min);
```

Data Dependency

Control Dependency

Any problems within this PDG?

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Data dependencies:	**Missing: 2->15, 1->3, 14->14, 14->11, 11->10, 14->10, 14->8, 14->7, 4->6, 8->7,** **Wrong Direction:** **Should be removed: 1->15, 5->12**
Control dependencies:	**Missing:** **Wrong Direction:** **Should be removed:**

Question #4

In a recent department meeting your new boss made the following statement. I just read a research paper which discussed software aging and I am not sure if the claims in the paper are correct. In their paper the authors state that the cause for software aging is: (1.) ignorant surgery – that is modifications being performed to a software product by people who are not necessarily skilled/trained enough to perform such software changes; as well as by (2.) too much movement, that is, software is changed to remove technical debt.

Your boss is asking if you agree/disagree with the two claims made in the paper. Clearly state if you agree/disagree with each claim (1.) and (2.) and briefly justify your decisions (max. 50 words)

Claim #1 – Correct. Ignorant surgery can cause software aging, since less skilled/experienced programmers might lack the necessary domain (application and programming) expertise to fully understand the problem and/or being able to find a good solution to the problem and can implement and test it. Often the break existing code and design structures - often unintentionally since they do not know better.

Claim #2 – Incorrect. Software aging would occur due to a **lack** of movement that is a system no longer receives the necessary updates (features, functionality) to meet the changing needs of the customers/stakeholders.

Also removing technical debt would actually improve the maintainability of the software and therefore slow down software aging.

Question #5

Given is the following statement: The major objective of perfective maintenance is to reduce technical debt in a software system.
Is the above statement, correct? Clearly indicate if you agree/disagree. Briefly justify your answer (1-2 sentences).

Incorrect - Perfective maintenance is related to improve the features of a system. It typically addresses features that were omitted in previous releases or which were newly requested by various stakeholders. Technical debt is removed as part of preventative maintenance and not perfective maintenance.