RYERSON UNIVERSITY

Faculty of Engineering, Architecture and Science

Department of Electrical and Computer Engineering

Course Number	891
Course Title	Software Testing and Quality Assurance
Semester/Year	W2023

Instructor	Dr. Reza Samavi

Lab No.	6

Lab Title	Control Flow Graph and Data Flow Coverage

Submission Date	March 20th, 2023
Due Date	March 21st, 2023

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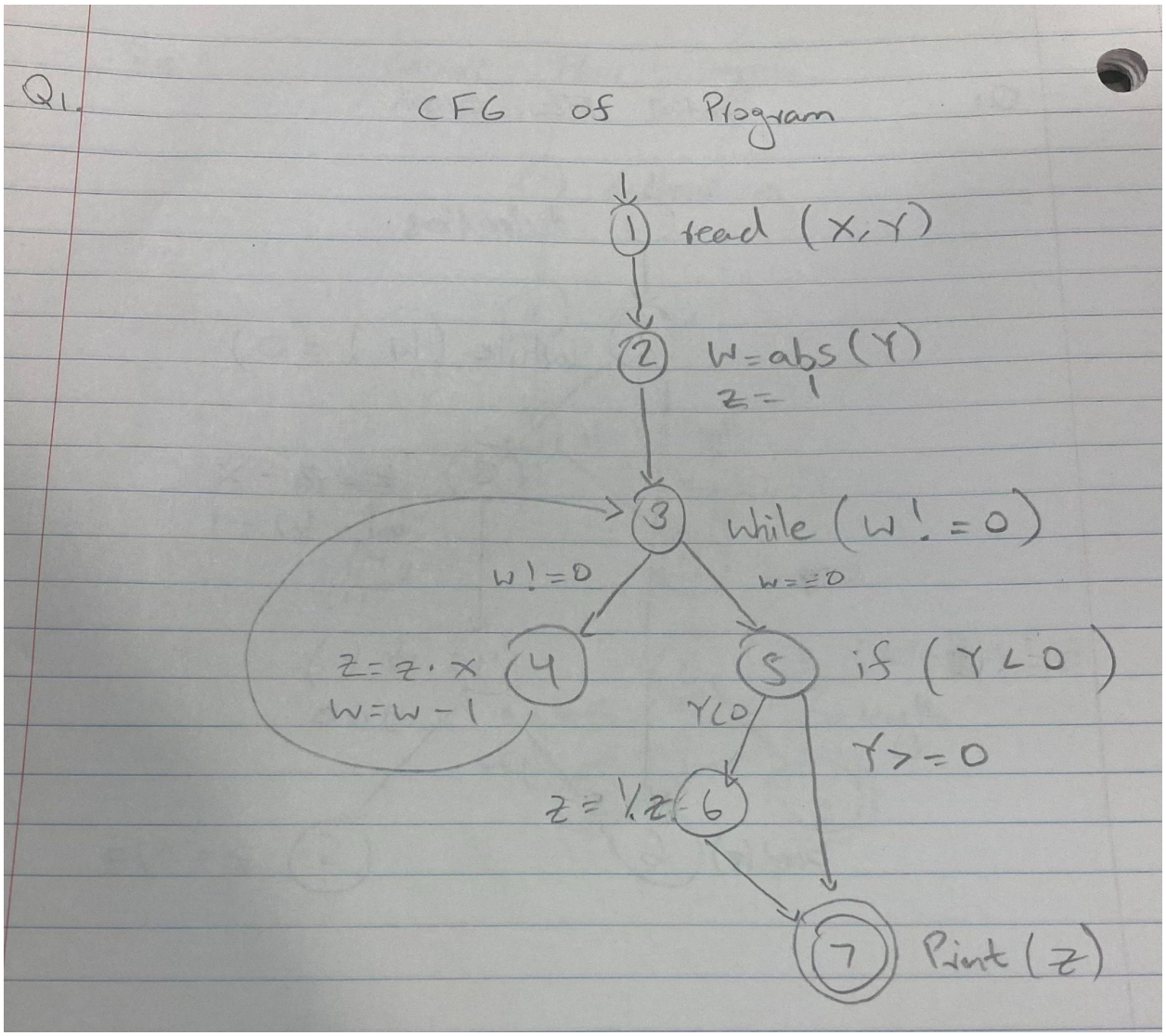
**By signing above you attest that you have contributed to this written lab report and confirm that all work you have contributed to this lab report is your own work.*

Q1:



1.

Infeasible paths: There are no infeasible paths in this program as all paths can be executed under some input values.

2.

Enough Test cases for **node coverage**:

TR (NC) = {[1], [2], [3], [4], [5], [6], [7]}

i) x= 3, y= 4

ii) x= 0, y= 3
iii) x= -3, y= -2
iv) x= 2, y= 0

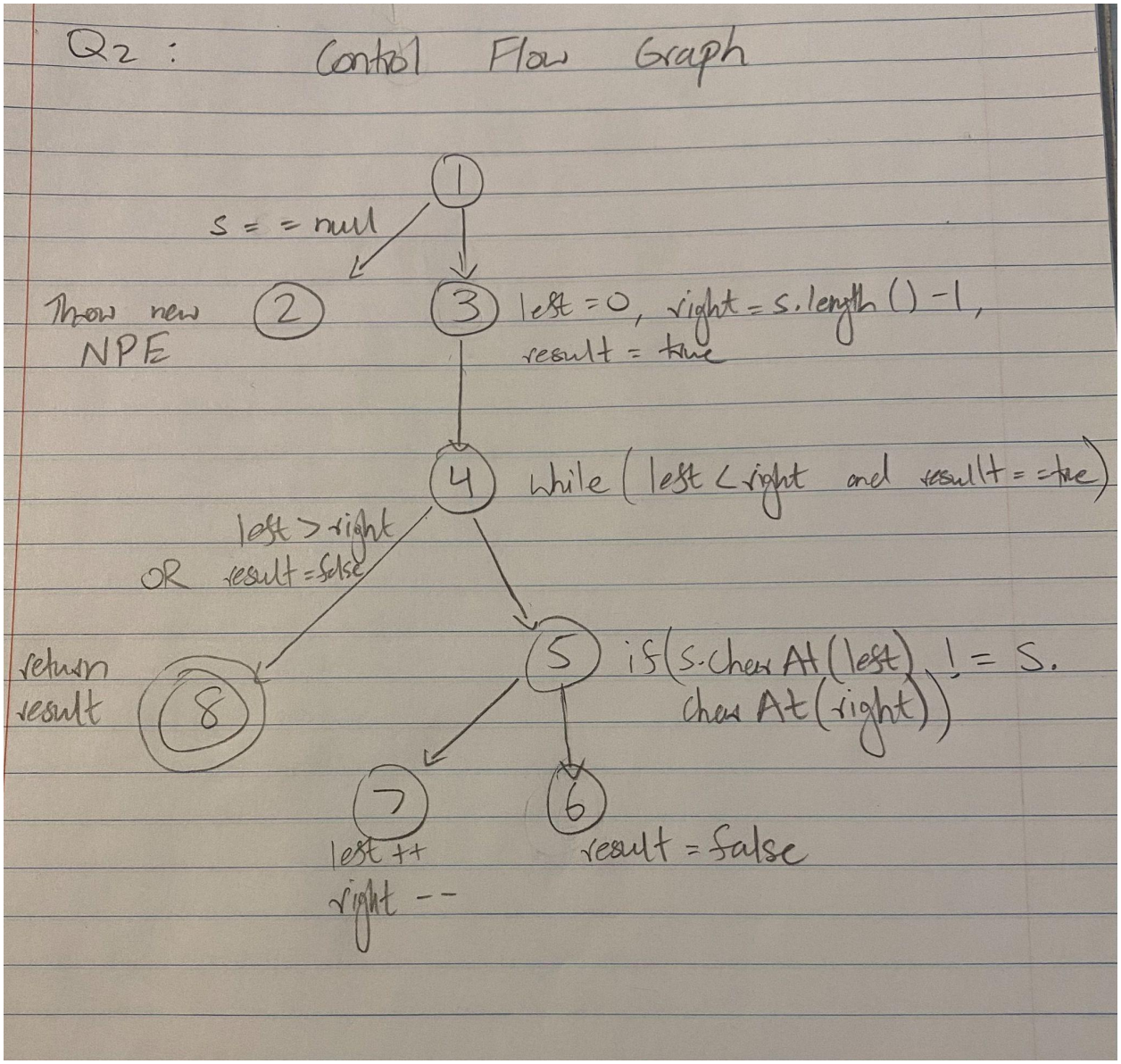
3.

Enough Test cases for **edge coverage:**

TR (EC) = {[1,2], [2,3], [3,4], [3,5], [4,3], [5,6], [6,7], [5,7]}

i) x=2, y=4
ii) x=2, y=-2
iii) x=0, y=4
iv) x=-1, y=-4

Q2:



2.

TR (NC) = {[1], [2], [3], [4], [5], [6], [7], [8]}
TR (EC) = {[1,2], [1,3], [3,4], [4,5], [4,8], [5,6], [5,7]}
TR (EPC) = {[1,3,4], [3,4,8], [3,4,5], [4,5,6], [4,5,7], [5,6,4], [5,7,4], [6,4,5], [7,4,8], [7,4,5]}

3.

Test set (NC but not EC) = Not possible as EC subsumes NC
Test set (EC but not EPC) = { [1,2], [1,3,4,5,6,4,5,7,4,8] }
Test set (EC but not EPC) = { [1,2], [1,3,4,5,7,4,5,6,4,8] }
Test set (EPC) = {[1,3,4,8], [1,3,4,5,7,4,5,6,4,8], [1,3,4,5,6,4,5,7,4,8]}

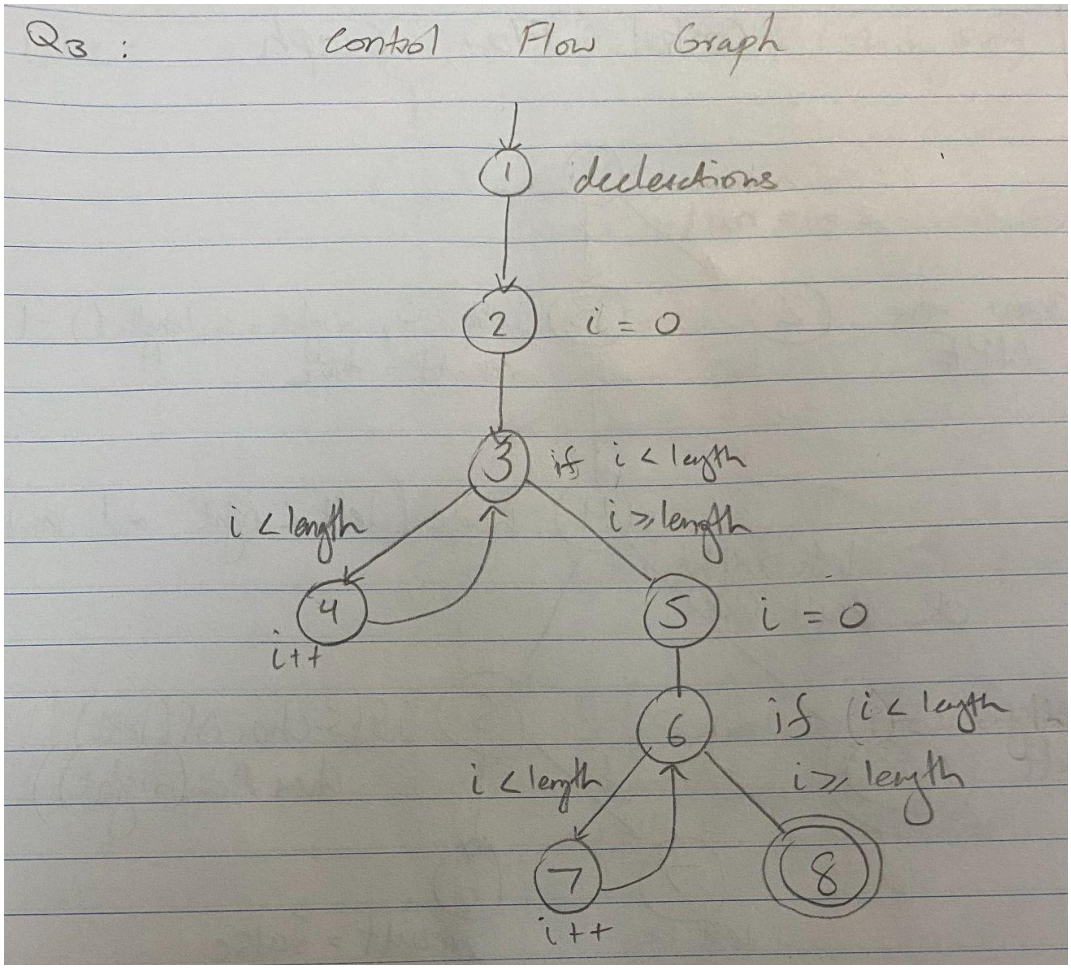
4.

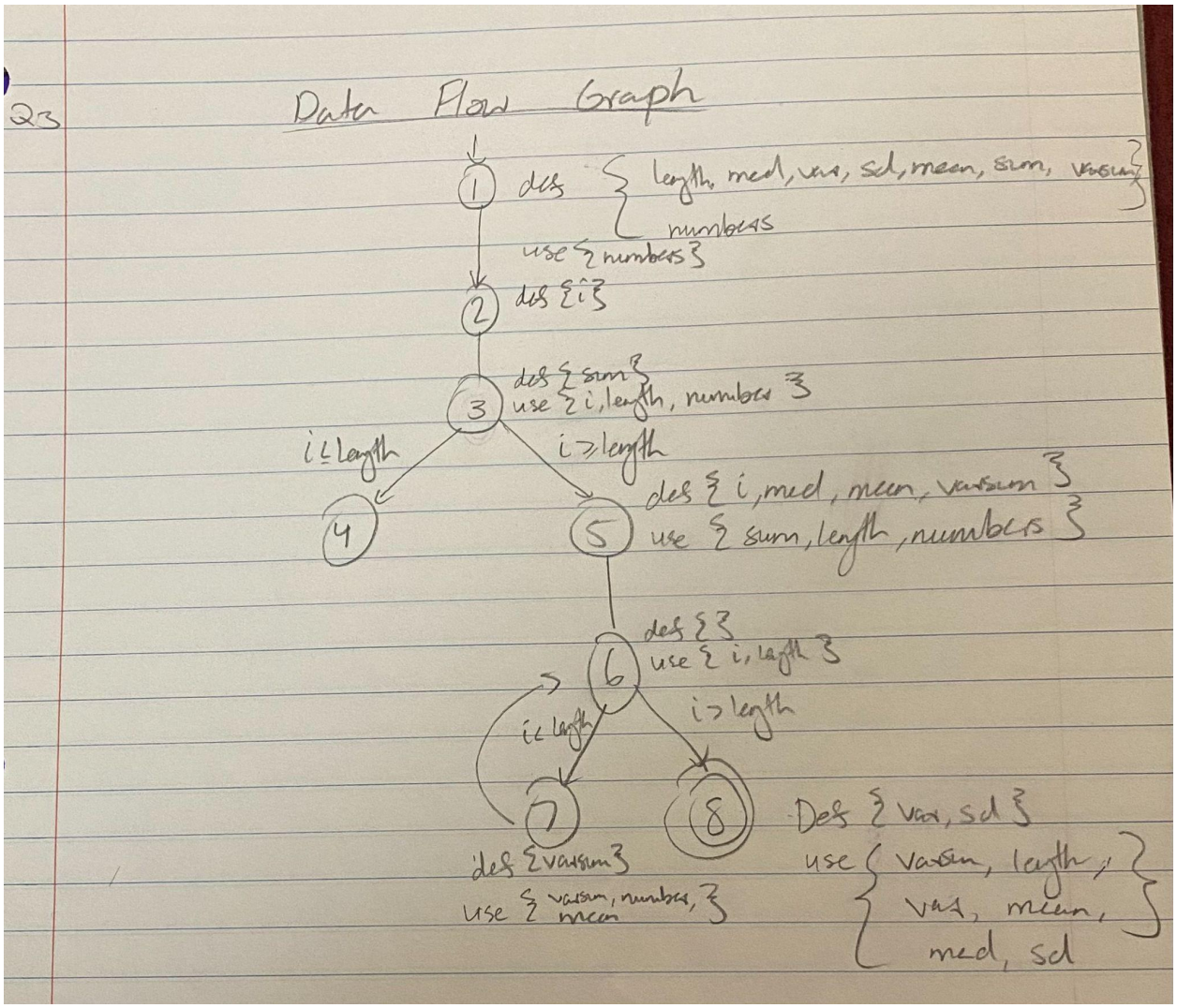
TR (PPC) = {[1,2], [1,3,4,8], [1,3,4,5,6] [4,5,7,4], [1,3,4,5,7], [4,5,6,4]}

There are no infeasible requirements as all TR can be satisfied.

Q3:

1.





2.

Variable	**Du pair**
i	(1,2), (1,4), (1,6)
length	(1), (1,3), (1,7), (1,8)
med	(1), (1,7)
var	(1), (1,9)
sd	(1)
mean	(1), (1,7), (1,8)

sum	(1), (1,3), (1,4),
numbers	(1,3), (1,4), (1,7),(1,8)
varsum	(1), (1,7), (1,8)

3.

Variable	**Du path**
i	{[1], [1,2], [5,6]}
length	{[1,2,3,4,5,6,7,8,9]}
med	{[1,2,3,4,5,6,7,8,9]}
var	{[1,2,3,5,6,7,8]}
sd	{[1,2,3,5,6,8,7,9]}
mean	{[1,2,3,5], [5,6,7,9]}
sum	{[1,2,3,4], [3,4], [3,4,3,5], [3,5,6,8], [3,4,3,5,6,7,9]}
numbers	{[1,3], [1,3,5], [1,3,5,6,7,9]}
varsum	{[1,2,3,5], [5,6,7,9]}

4.

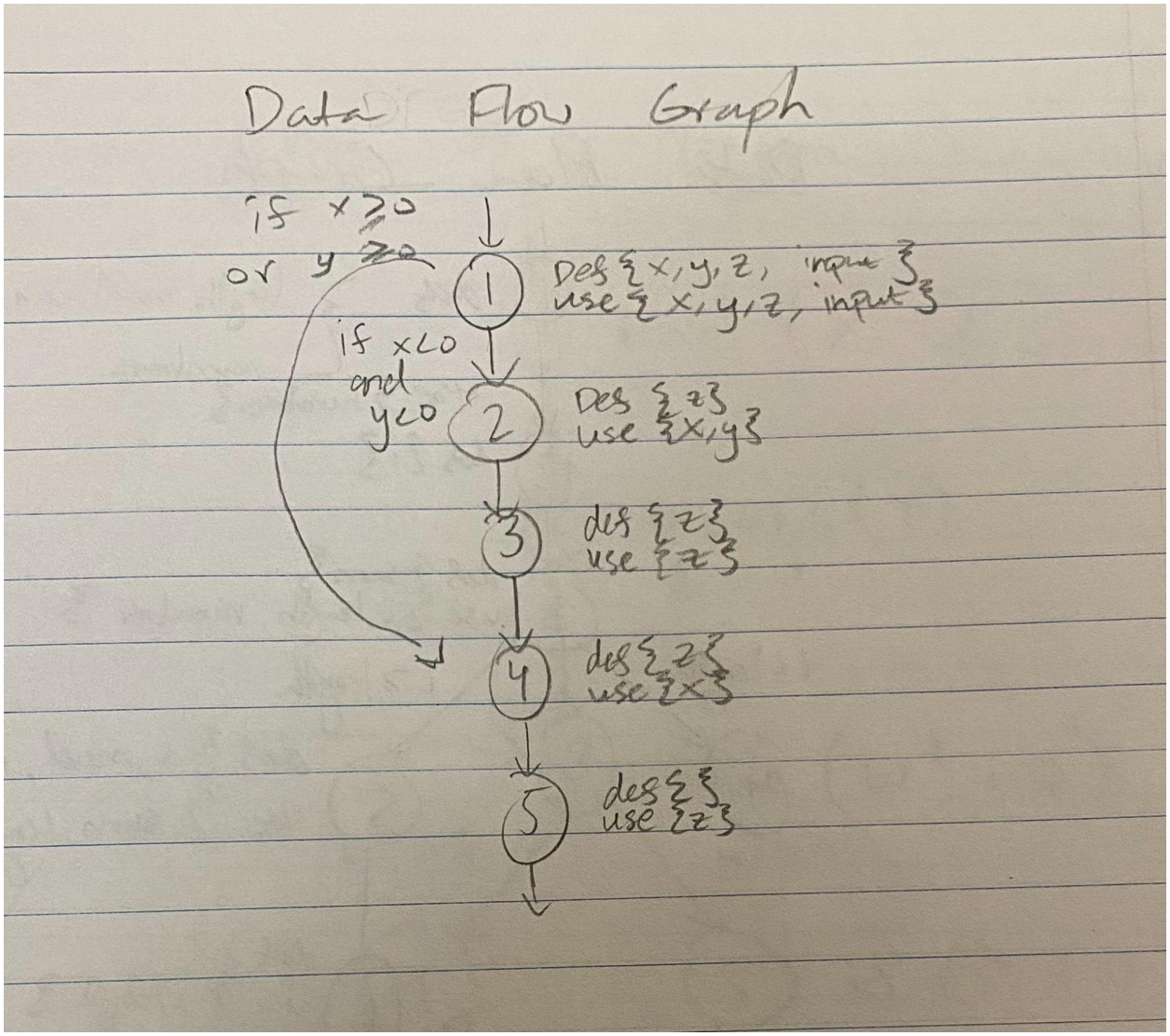
Test Cases: {[1], [1,2,3], [0, -2, 4, 5]}

5.

The du paths that require arrays with length 0, the program will not be able to compute and provide a value for the median variable. The “why” is mainly and solely due to the fact that the array of length 0 has no middle element and therefore cannot calculate the median value.

Q4:

1.



2.

def (1) = {x,y,z}
use (1) = {z,x,y}

def (2) = {}
use (2) = {x,y}

def (3) = {}
use (3) = {z}

def (4) = {}
use (4) = {z,x}

def (5) = {}
use (5) = {z}

3.

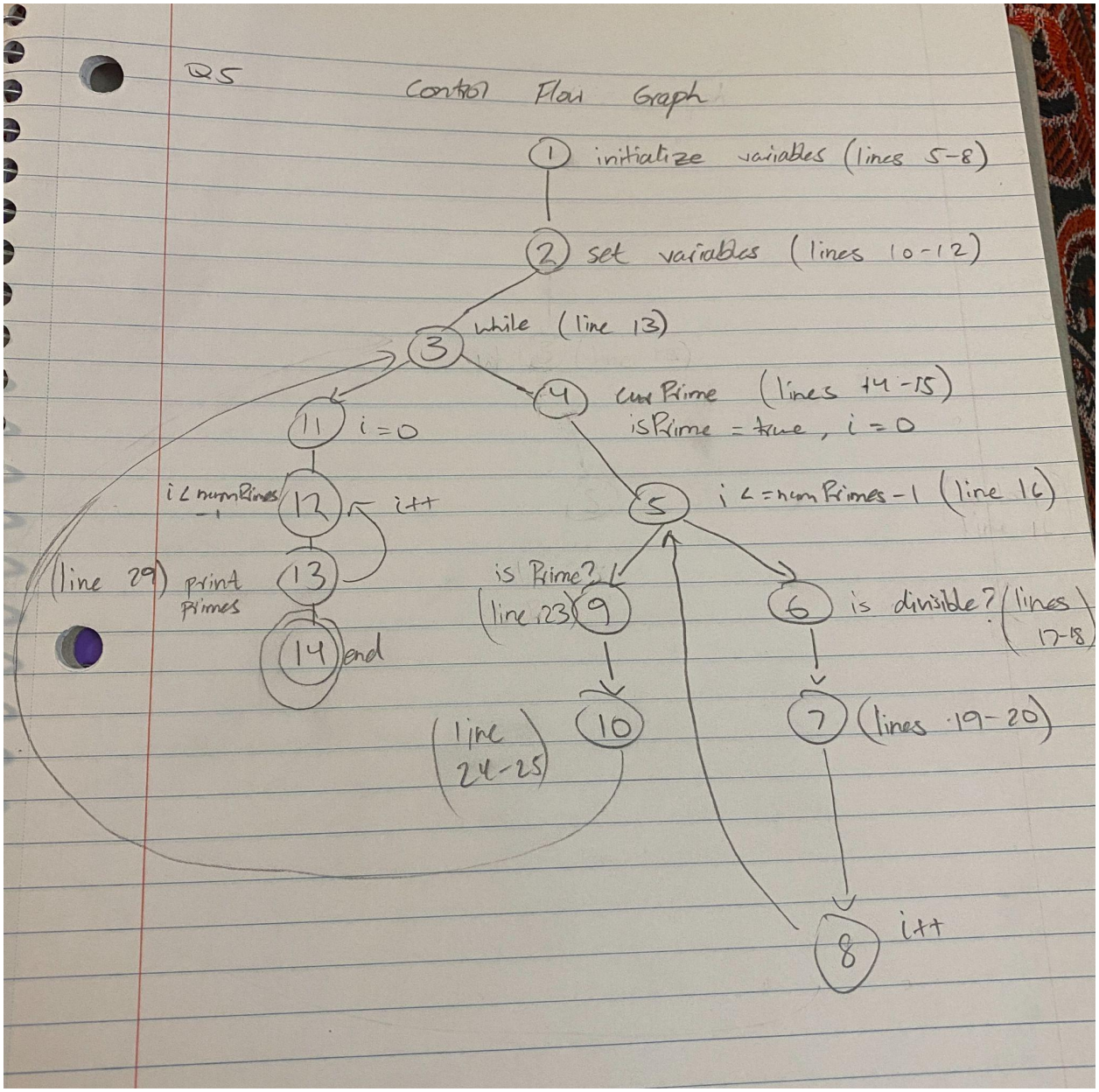
Node	**P-use**	**C-use**
1	x,y	z
2	y	z,x
3	-	z
4	-	z,x
5	-	-

4.

Node	**Dc-path**	**Du-path**
1	All	[1-2], [1-4]
2	All	[1-2], [2-5]
3	All	[1-2], [1-2-3], [1-2-3-9], [1-4]
4	All	[4,5]
5	All	-

Q5:

1.



2.

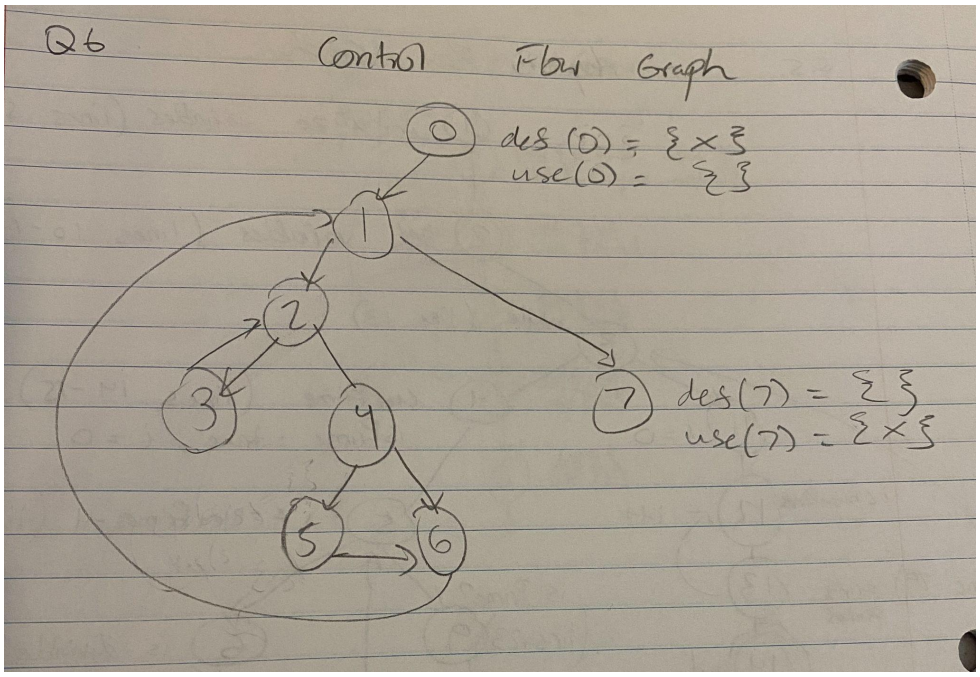
A test case such that the corresponding test path visits the edge that connects the beginning of the while statement (node 3) to the for statement that appears after the while loop (node 12), without going through the body of the while loop (passing over nodes 4,5,6,7,8,9), the initial values of numPrimes must be greater than or equal to n.

3.

Name	Input	Testpath
testOne	n= 0	[1,2,3,11,12,13,14]
testTwo	n= 2	[1,2,3,4,5,6,7,8,9,10,11,12, 13,14]

Q6:

1.



2.

List of all du-paths with respect to x: [0, 1, 7] and [0, 1, 2, 4, 5, 6, 1, 7].

3.

Du-path [0,1,7] is du-toured by t2: [0, 1, 2, 4, 6, 1, 7] and t3: [0, 1, 2, 4, 5, 6, 1, 7]

4.

Minimal test set that satisfies all-defs coverage with respect to x (Direct tours only):
1. t2: [0, 1, 2, 4, 6, 1, 7]
2. t4: [0, 1, 2, 3, 2, 4, 6, 1, 7]
3. t5: [0, 1, 2, 3, 2, 3, 2, 4, 5, 6, 1, 7]
4. t6: [0, 1, 2, 3, 2, 4, 6, 1, 2, 4, 5, 6, 1, 7]

5.

Minimal test set that satisfies all-uses coverage with respect to x (Direct tours only):
1. t2: [0, 1, 2, 4, 6, 1, 7]
2. t3: [0, 1, 2, 4, 5, 6, 1, 7]
3. t4: [0, 1, 2, 3, 2, 4, 6, 1, 7]

6.

Minimal test set that satisfies all-du-paths coverage with respect to x (Direct tours only):
1. t6: [0, 1, 2, 3, 2, 4, 6, 1, 2, 4, 5, 6, 1, 7]