**Task C**

Answer queries below (with respect to program Bill) in the format as shown below for a sample query.

*stmt s, s1; assign a, a1, a2; while w; if ifstat; procedure p; variable v; constant c; prog\_line n, n1, n2;*

*// declarations refer to all the queries listed below*

Q 1. **Select** s **such that** Parent (s, s1) **with** s1.stmt#= n

Give answers for n = **3**, **11, 13, 21**

n=3: none

n=11: 9

n=13: 11

n=21: 19

Q 2. **Select** s **such that** Parent (s, n) // what’s the difference between query Q1 and Q2?

Give answers for n = **3**, **13, 15, 22**

n=3: none

n=13: 11

n=15: 11

n=22: 19

Q3. **Select** s **such that** Parent (n, s)

Give answers for n = **2**, **9**, **10, 11**

n=2: none

n=9: 10, 11, 17

n=10: none

n=11: 12, 13, 14, 15, 16

Q4. **Select** s **such that** Parent\* (s, n) Give answers for n = **2, 10**, **15**, **21**

n=2: none

n=10: 9

n=15: 9, 11

n=21: 19

Q5. **Select** w **such that** Parent\* (w, n)

Give answers for n = **2, 10, 13, 17, 22**

n=2: none

n=10: 9

n=13: 9

n=17: 9

n=22: 19

Q6. **Select** s **such that** Parent\* (w, n)

Give answers for n = **10, 3**

n=10: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 ,13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

n=3: none

Q7. **Select** s **such that** Follows (s, n)

Give answers for n = **1**, **3, 9, 10, 19**

n=1: none

n=3: 2

n=9: 8

n=10: none

n=19: none

Q8. **Select** a **such that** Follows (a, n) // what is the difference between queries Q6 and Q7?

Give answers for n = **1**, **3, 9, 10, 18**

n=1: none

n=3: 2

n=9: 8

n=10: none

n=18: none

Q9. **Select** w **such that** Follows\*(s,w)

9

Q10. **Select** s **such that** Follows\* (s,n)

Give answers for n = **2, 10, 11, 21**

n=2: 1

n=10: none

n=11: 10

n=21: 20

Q11. **Select** ifstat **such that** Follows\*(ifstat,n)

Give answers for n = **10**, **17**

n=10: none

n=17: 11

Q12. **Select** a **such that** Follows\* (a, n)

Give answers for n = **4, 5, 9, 17, 22**

n=4: 1, 2, 3

n=5: 1, 2, 3, 4

n=9: 1, 2, 3, 4, 6, 8

n=17: 10

n=22: 20

Q13. **Select** v **such that** Modifies (n, v) Give answers for n = **3, 5, 9, 11**

n=3: “y”

n=5: “z”, “y”

n=9: “e”, “y”, “i”, “x”, **“z”**

n=11: “y”, “i”, “x” , **“z”**

Q14. **Select** w **such that** Modifies (w,v)

Give answers for v = “**i”**, “**y”**

v=”i”: 9, 19

v=”y”: 9, **19**, 27

Q15. **Select** v **such that** Modifies (“Mary”,v)

v = “z”,” i, “y”

Q16. **Select** s **such that** Uses (s, v)

Give answers for v = “**i”**, “**y”**

v=”i”: 9, 16, 19, 22, 23, 28

11, 18, 21, 27

v=”y”: 4, 10, 12, 13, 14, 17, 20, 23, 30

5, 9, 11, 18, 19, 21, 27, 28

Q 17. **Select** v **such that** Uses (n, v)

Give answers for n = **10, 18**

n=10: x, y

n=18: “i”, “z”, “y”, ”e”, “d”, “x”

Q18. **Select** v **such that** Uses (a, v)

Q19. **Select** a **such that** Modifies (a, v) **and** Uses (a, v)

Give answers for v = “**i”**, “**z”**

v=”i”: 16, 22,

v=”z”: 25, 30

Q20. **Select** a **such that** Modifies (a, “z”) **and** Parent (w, a)

//Select an assignment a such that a modifies “z” and the parent of a is a while loop

20, 25**~~, 30~~**

Q21. **Select** a **such that** Parent (w, a) **and** Modifies (a, “z”)

20, 25**~~, 30~~**

Q22. **Select** a **such that** Modifies (a, “z”) **such that** Parent (w, a)

20, 25

Q23. **Select** p **such that** Calls\* (p, “John”)

p= “Bill”, “Mary”,

Q 24. **Select** p **such that** Calls (“Bill”, p) **and** Modifies (p, “i”) **and** Uses (p, “x”)

//Select a procedure p such that p calls Bill and p modifies “i” and p uses “x”

“Mary”

Q25. **Select** p **such that** Calls\* (“Bill”, p) **and** Modifies (p, “y”)

//Select a procedure p such that p calls Bill and p modifies “y”

“Mary”, “John”

Q26. **Select** a **pattern** a (“y”, \_)

Stmt 3, 12, 23, 29

Q27. **Select** a **pattern** a (“z”, “2\*x”)

None

Q28. **Select** a **pattern** a (“x”, \_) **such that** Follows (w, a)

*Select an assignment a with pattern “x” such that the assignment appears immediately after a while loop at the same nesting level*

26

Q29. **Select** a **pattern** a (\_, “y+1”)

13

Q 30. **Select** a **pattern** a (\_, “x-y”)

10

Q31. **Select** a **pattern** a (\_, \_“y\*3+2”\_)

None

Q 32. **Select** a **pattern** a (\_, \_“y+e\*d”\_)

**none**

Q33. **Select** a **pattern** a (\_, \_“y+z”\_)

12, 14, 17, 23

Q34. **Select** a **pattern** a (\_, \_“z+i”\_)

None

Q35. **Select** a **pattern** a (\_, \_“2\*x”\_)

20

Q36. **Select** a **pattern** a (\_, \_“3+2”\_)

None

Q37. **Select** s **with** s.stmt# = c.value

**1, 2, 3, 4, 5, 10, 12**

Q 38. **Select** BOOLEAN **pattern** ifstat ("i", \_, \_) **with** c.value = 10

**True**

Q39. **Select** n2 **such that** Next (n1, n2)

Give answers for the following values of n1: **1, 9, 11, 13, 15, 17, 18**

n1=1: 2

n1=9: 10, 18

n1=11: 12, 14

n1=13: 17

n1=15: 16

n1=17: 9~~, 18~~

n1=18: none

Q40. **Select** n1 **such that** Next (n1, n2)

Give answers for the following values of n2: **1, 9, 10, 17, 18, 19**

n2=1: none

n2=9: 8, 17

n2=10: 9

n2=17: 13, 16

n2=18: 9, 17

n2=19: 22

Q41. **Select** n **such that** Next\* (10, n) and Next\* (n, 9)

9, 10, 11, 12, 13, 14, 15, 16, 17

Q42. **Select** n **such that** Next\* (n, n)

9, 10, 11, 12, 13, 14, 15, 16, 17, 19 20, 21, 22, 24, 25, 27, 28, 29, 30

Q43. **Select** BOOLEAN **such that** Affects (a1, a2)

Give answers for the following (a1, a2) values: (**1, 2**), (**1, 3**), (**1, 5**), (**2, 6**), (**2, 8**), (**3, 12**), (**3, 13**), (**16, 21**)

(1, 2) = True

(1, 3) = True

(1, 5) = **False**

(2, 6) = True

(2, 8) = False

(3, 12) = False

(3, 13) = False

(16, 21) = False

Q44. **Select** a1 **such that** Affects (a1, a2)

Give answers for a2 = **1, 10**

a2=1: none

a2=10: **12, 17 (While Loop go back)**

Q45. **Select** a2 **such that** Affects (a1, a2)

Give answers for a1 = **1, 13**

a1=1: 2, 3

a1=13: 16

Q46. **Select** BOOLEAN **such that** Affects\* (a1, a2)

Give answers for the following (a1, a2) values: (**1, 2**), (**1, 3**), (**1, 6**), (**1, 8**), (**11, 14**), (**20, 20**)

(1, 2): True

(1, 3): True

(1, 6): True

(1, 8): True

Affects (1,2), Affects(2,3), Affects(3,4), Affects (4,6)

Z is modified in Jane, Affects does not hold

X is modified in Jane, Affects does not hold

However Affects(6, 8) holds and hence by transitivity Affects\*(1, 8) holds by the following sequence

Affects (1,2), Affects(2,3), Affects(3,4), Affects (4,6), Affects(6, 8)

(11, 14): False

(20, 20): **False**

Affects(20, 29), Affects(29,20)

Hence by transitivity, Affects\*(20, 20) holds

Q47. **Select** a1 **such that** Affects\* (a1, a2)

Give answers for a2 = **12, 26**

a2=16: **12**

a2=26: 25

Q48. **Select** a2 **such that** Affects\* (a1, a2)

Give answers for a1 = **6, 20**

a1=6: 8

a1=20:  **None**