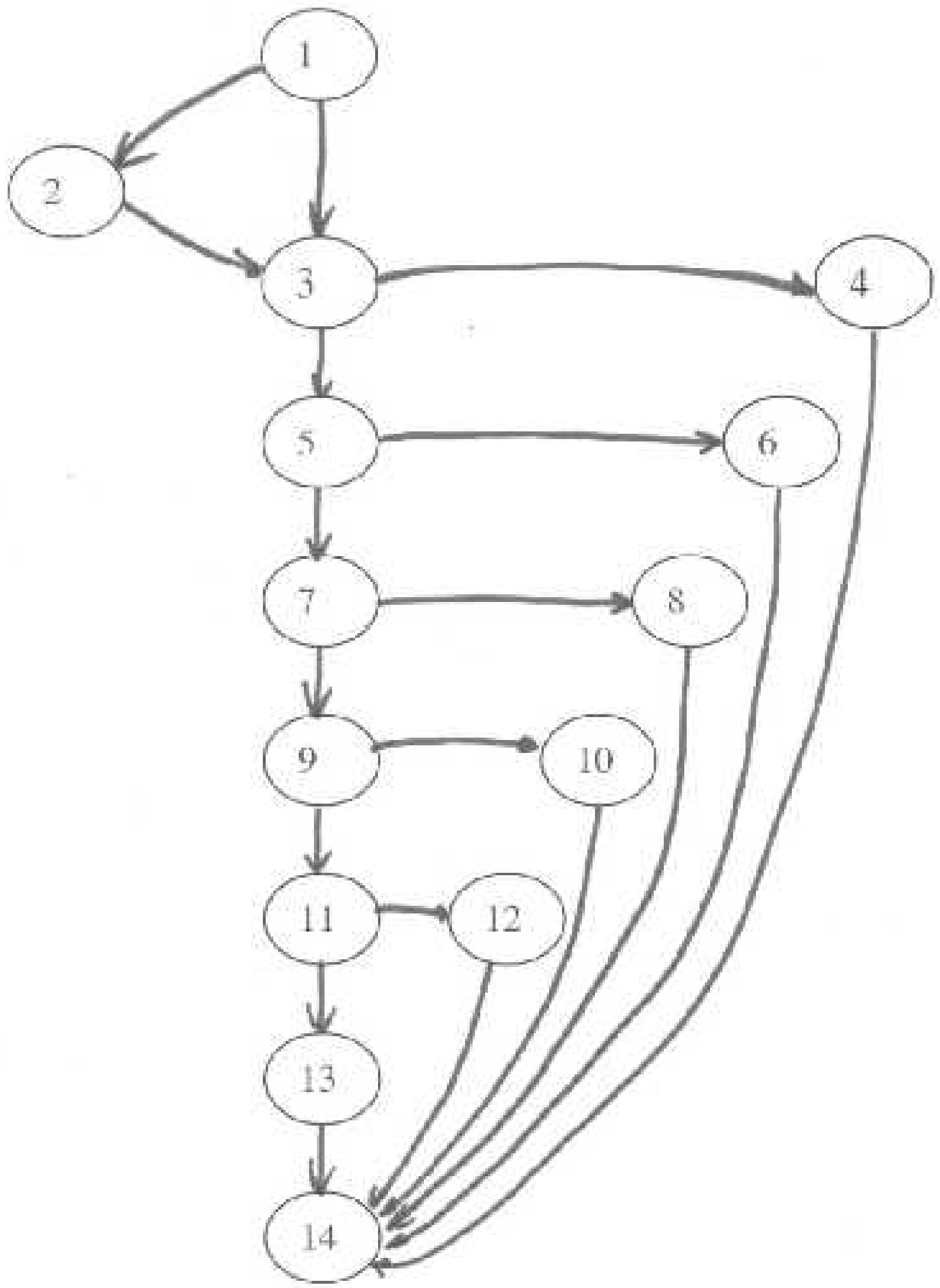
Basis Path Testing Example

Step 1: Draw the flow graph for the algorithm.

The example procedure below shows how the algorithm statements are mapped into graph nodes, numbered on the left.

```
    public double calculate(int amount)
    {

-1-  double rushCharge = 0;

-1-  if (nextday.equals("yes") )
     {
-2-       rushCharge = 14.50;
     }

-3-  double tax = amount * .0725;

-3-  if (amount >= 1000)
     {
-4-       shipcharge = amount * .06 + rushCharge;
     }
-5-  else if (amount >= 200)
     {
-6-       shipcharge = amount * .08 + rushCharge;
     }
-7-  else if (amount >= 100)
     {
-8-       shipcharge = 13.25 + rushCharge;
     }
-9-  else if (amount >= 50)
     {
-10-      shipcharge = 9.95 + rushCharge;
     }
-11- else if (amount >= 25)
     {
-12-      shipcharge = 7.25 + rushCharge;
     }
     else
     {
-13-      shipcharge = 5.25 + rushCharge;
     }

-14- total = amount + tax + shipcharge;
-14- return total;

     } //end calculate
```

Here is a drawing of the flowgraph.



Step 2: Determine the cyclomatic complexity of the flow graph.

V(G) = E - N + 2
= 19 - 14 + 2
= 7

This tells us the *upper bound* on the size of the basis set. That is, it gives us the number of independent paths we need to find.

Step 3: Determine the basis set of independent paths.

Path 1: 1 - 2 - 3 - 5 - 7 - 9 - 11 - 13 - 14
Path 2: 1 - 3 - 4 - 14
Path 3: 1 - 3 - 5 - 6 - 14
Path 4: 1 - 3 - 5 - 7 - 8 - 14
Path 5: 1 - 3 - 5 - 7 - 9 - 10 - 14
Path 6: 1 - 3 - 5 - 7 - 9 - 11 - 12 - 14
Path 7: 1 - 3 - 5 - 7 - 9 - 11 - 13 - 14

Note: This basis set is not unique. There are several different basis sets for the given algorithm. You may have derived a different basis set.

The basis set "covers" all the nodes and edges in the algorithm.

Step 4: Prepare test cases that force execution of each path in the basis set.

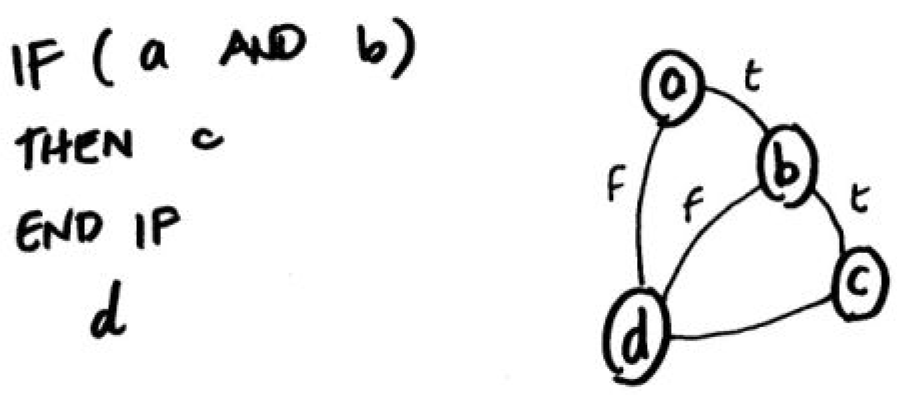
path	nextday	amount	expected result
1	yes	10	30.48
2	no	1500	????.??
3	no	300	345.75
4	no	150	174.125
5	no	75	90.3875
6	no	30	39.425
7	no	10	15.975

Recommended: Use the Basis Path Worksheet to record your test cases.

Wrinkles

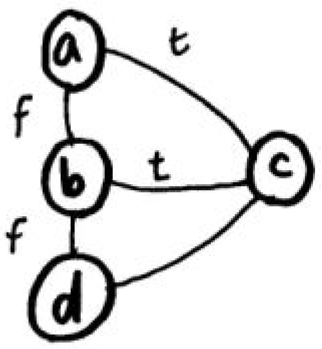
- a return statement in the middle of a block is treated as though there were an arc to the end. Otherwise it's an extra terminal symbol.
- a return of a boolean expression is treated as an if statement.
- Exceptions are messy as they can potentially cause interruption in flow of control at any statement in the block. It may be easiest to simply choose a single arbitrary exception point.
- complex conditions are represented as a separate node for each condition.

Flowgraph for boolean **AND**



Flowgraph for boolean **OR**

```
IF (a OR b)
THEN c
END IF
d
```



Note: Basis Path testing is **not** sufficient in itself. It must be supplemented with other white box techniques or a formal correctness proof.