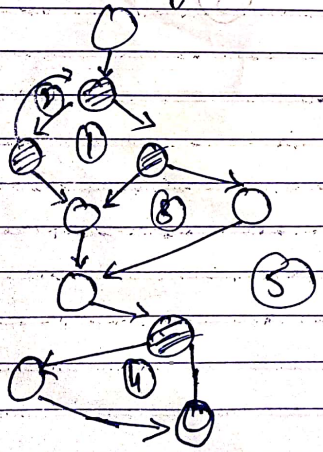
CYCLOMATIC COMPLEXITY

- Cyclomatic Complexity is software metric used to measure complexity of program
- Control Flow Graph is used to measure the Cyclomatic Complexity of a code.
- It known as structural complexity
  ∵ it gives the internal view of the code.
  i.e. It is a type of white box testing.
- It is developed by Mc Cabe in 1976

Eg :- Flowgraph



Three Method to Calculate Cyclomatic Complexity

1. $V(G) = E - N + 2P$ (Branches / Edges / Nodes method)
   { E = Edges, N = no. of nodes, P = connected components [P = 1] } ← no. of
   $= 13 - 10 + 2(1)$
   $= 3 + 2 = 5$

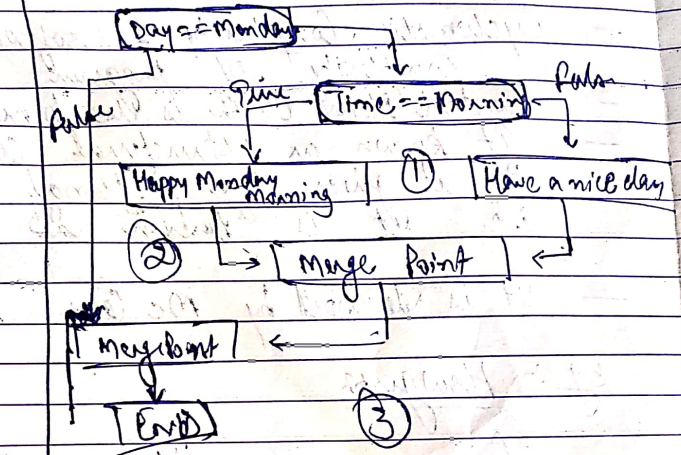
2. Branch method: $V(G) = P + 1$
   { P = Predicate node → node having two outgoing edges }
   $= 4 + 1$
   $= 5$

3. $V(G)$ = No. of Regions
   $= 5$

Eg:- Code

```
if (Day == "Monday")
{
  if (Time == "Morning")
  {
    Happy Monday Morning
  }
  else
  {
    Have a nice day
  }
}
print (END);
```

Control flow graph:



1. V(G) = E − N + 2
   = 8 − 7 + 2
   = 3

2. V(G) = P + 1
   = 2 + 1 = 3

3. V(G) = No. of Region ⇒ 3

Acceptable Range of for Code using Cyclomatic Complexity

* 1 — 5 = Easy to Maintain
* 6 — 10 = Difficult to m
* 11 — 15 = Very Difficult
* 20+ = Approaching Impossible

S/w Reliability

- Reliability of a S/w specifies probability of failure free operation for a given time duration.
- It is a dynamic System characteristics
  ↳ a function of no. of s/w failure reported.
- Failure :- It is a Execution Event where the S/w behaves unexpectedly manner.

S/w Reliability metrics : (4 types of Metrics)

1. Probability of failure on Demand :- It is a measure of the likelihood that the system will behave in an Unexpected way when some demand is made on it. Eg:- Safety - critical System within chances fail
2. Rate of Occurance of Failure (ROCOF) :- A measure of frequency of occurance with which Unexpected behaviours is likely to be observed.
   Eg:- ROCOF $\frac{9}{100}$ → S/w will fail 9 times out of 100 operational unit times.

FCMTTF)/F

3 Mean time to failure :- * A measure of time interval b/w observed failure.

* useful when system is stable and no changes are being made to it.

∴ Indication of how long the system will be operational before failure occurance.

4 - Mean time to Repair

5 - Mean time between failure :-

MTBF = MTTF + MTTR

6 Availability :- Measure of how likely the system is to be available for use.

Availability = (%) / 100 % time available

Availability = $\left(\frac{MTTF}{MTTF+MTTR}\right) * 100\%$