MC/DC Coverage

- MC/DC is defined in DO-178B/ED-12B, -"Software Considerations in Airborne Systems and Equipment Certification", dated December 1, 1992.

- Definition of MC/DC:

(1) Every point of entry and exit in the program has been invoked at least once

(2) Every condition in a decision in the program has taken all possible outcomes at least once

(3) Every decision in the program has taken all possible outcomes at least once

(4) Each condition in a decision has been shown to independently affect that decision's outcome. A condition is shown to independently affect a decision's outcome by varying just that condition while holding fixed all other possible conditions

MC/DC

- MC/DC criteria is stronger than Condition/Decision

- 100% MC/DC will guarantee that each simple condition will not be masked by the other conditions.

- Consider the following decision: $x < 0$ OR $y < 0$
- If $x = -1$, then $x < 0$ is true and it will mask the condition $y < 0$, since no matter $y < 0$ is true or not, the whole decision will be evaluated to true.

- 100% MC/DC guarantees 100% C/D

MC/DC Example

- Considering the following code:

```
int isReadyToTakeOff(int a, int b, int c, int d)
{
        if(((a == 1) ||(b == 1)) && ((c == 1) || (d == 1)))
                return 1; else return 0;
}
```

$$T_1 = \begin{Bmatrix} t_1 : < a = 0, b = 1, c = 1, d = 1 > \\ t_2 : < a = 0, b = 0, c = 0, d = 1 > \\ t_3 : < a = 1, b = 0, c = 0, d = 0 > \end{Bmatrix} \quad 100\%\ C/D$$

$$T_2 = \begin{Bmatrix} t_1 : < a = 1, b = 0, c = 1, d = 0 > \\ t_2 : < a = 1, b = 0, c = 0, d = 1 > \\ t_3 : < a = 0, b = 1, c = 0, d = 1 > \\ t_4 : < a = 1, b = 0, c = 0, d = 0 > \\ t_5 : < a = 0, b = 0, c = 0, d = 1 > \end{Bmatrix} \quad 100\%\ MC/DC$$

MC/DC Example

$$T_2 = \begin{Bmatrix} t_1 : < a = 1, b = 0, c = 1, d = 0 > \\ t_2 : < a = 1, b = 0, c = 0, d = 1 > \\ t_3 : < a = 0, b = 1, c = 0, d = 1 > \\ t_4 : < a = 1, b = 0, c = 0, d = 0 > \\ t_5 : < a = 0, b = 0, c = 0, d = 1 > \end{Bmatrix} \quad 100\%\ MC/DC$$

$t_2 + t_5$ shows the effect of $a = 1$;
- Values of b, c, d in t_2 and t_5 are same.
- when $a = 1$, t_2 → true;
- when $a = 0$, t_5 → false;

$t_3 + t_5$ shows the effect of $b = 1$;
- Values of a, c, d in t_3 and t_5 are same.
- when $b = 1$, t_3 → true;
- when $b = 0$, t_5 → false;

$t_1 + t_4$ shows the effect of $c = 1$;
- Values of a, b, d in t_1 and t_4 are same.
- when $c = 1$, t_1 → true;
- when $c = 0$, t_4 → false;

$t_2 + t_4$ shows the effect of $d = 1$;
- Values of a, b, c in t_2 and t_4 are same.
- when $d = 1$, t_2 → true;
- when $d = 0$, t_4 → false;