CU  Topic 2

MOORE m/c

Mealy m/c
The elements of a DPU can be compared to the individual workers such as carpenters and plumbers in a construction company who need to be told by their supervisor (the Control Unit) what they should they be doing in each hour (each clock). The control unit produces the necessary control signals as function of the state it is currently at. State transitions in the CU are influenced by (i) the current state, (ii) external inputs and (iii) status information generated in the DPU such as overflow.

Two types of state machines: The **MOORE** and the **MEALY** machines

In the **MOORE** machine, the output control signals are solely functions of the current state only.

In the **MEALY** machine, the output control signals are functions of the current state and some inputs. Activation of the outputs is contingent or conditional to some input(s).
Design Techniques

\[ S_3 \]
\[ X \leftarrow X - 25 \]

\[ S_3 \]
\[ \text{if } X \geq 25 \]
\[ X \leftarrow X - 25 \]
Mealy m/c example

DIVIDER
\[ \frac{x}{y} \in \mathbb{Q}, \mathbb{R} \]

\[ 13 \div 5 = \frac{13}{5} \]

\[ \begin{array}{c}
\underline{13} \\
- \underline{5} \\
8 \\
\underline{5} \\
3 \\
\end{array} \quad \rightarrow \quad Q=1 \quad R=3 \\
\begin{array}{c}
\underline{8} \\
- \underline{5} \\
3 \\
\end{array} \quad \rightarrow \quad Q=2
$\mu_{\text{Reset}}$

$Q_{i}

Q \leftarrow O_i$

$X \leftarrow X_{\text{ini}}$

$Y \leftarrow Y_{\text{ini}}$

$S$

$\overline{S}$
OFL output function logic

Q_i

Q_c

\( \sim BORROW \)

\( x \geq y \)

\( \sim x_{-load} \)

x_{-load}
Divider -- Mealy machine design

START

I
(INITIAL)
X <= XIN;
Y <= YIN;
Q <= 0;

START

X >= Y

C
(COMpare and UPDATE)
If X >= Y
X <= X - Y;
Q <= Q + 1;

X <= Y

D
(DONE)

END

END

RESET

 Divider-9
Divider -- Moore machine design

I (INITIAL)
X <= XIN;
Y <= YIN;
Q <= 0;

START

C (COMPARE)

1

X >= Y

D (DONE)

U (UPDATE)
X <= X - Y;
Q <= Q + 1;

END

END

X = Y

RESET