Topic 1

DPU and CU

Datapath unit and Control unit
Digital System

DPU
Data Path Unit

CU
Control Unit
Construction Company

Digital System

WORKERS
Elements of DPU

MANAGER

Control unit
puppet show

puppets

puppet show manager

control signals

strings
Digital System

Elements of DPU

DPU

Storage Computational Routing

State Machine

Control Signals
An example of Datapath Unit Design
Design a Data Path Unit to Support the RTL Operations:

\[ C \leftarrow A + B \]
\[ C \leftarrow A - B \]
\[ R \leftarrow P + Q \]
\[ R \leftarrow P - Q \]
ADD/SUB

A
P
B
Q

C
R

ALU

X
Y
Z
IDENTIFY THE

CONTROL SIGNALS

IN THE DATA PATH
CU
Design
CU Block diagram

NSL

SM

OFL
Encoded State assignment method

One-Hot State assignment method
CU Design using One-Hot State assignment
Traffic light control

Small Street

Main Street

$S_n$

$S_s$
SS  Small Straight
MT  Main Turn
MS  Main Straight
<table>
<thead>
<tr>
<th></th>
<th>$Q_{ss}$</th>
<th>$Q_{mt}$</th>
<th>$Q_{ms}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td></td>
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</tbody>
</table>
When would MS be the next state?

if SS is the current state and $S=0$

Or

if MT is the current state
NSL for MS state

Diagram:

- S
- QSS
- QMT
- DQ
- QMS
On power-on you want the state m/c to come into a known desired initial state
Random illegal state
a known desired initial state
\( \text{RESET} \rightarrow \text{on power-on reset} \)
Completed design

QMS

QSS

QMT

Diagram showing circuit designs and labels.