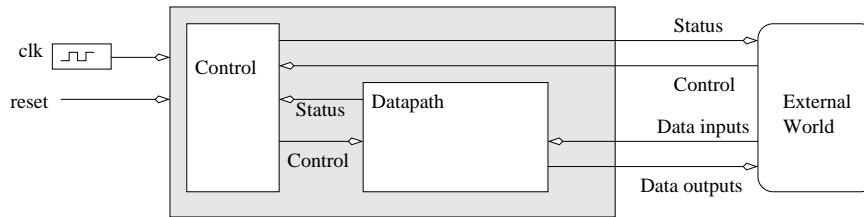


8 Chapter 8 – Datapath and Control

8.1 Helpfull Stuff

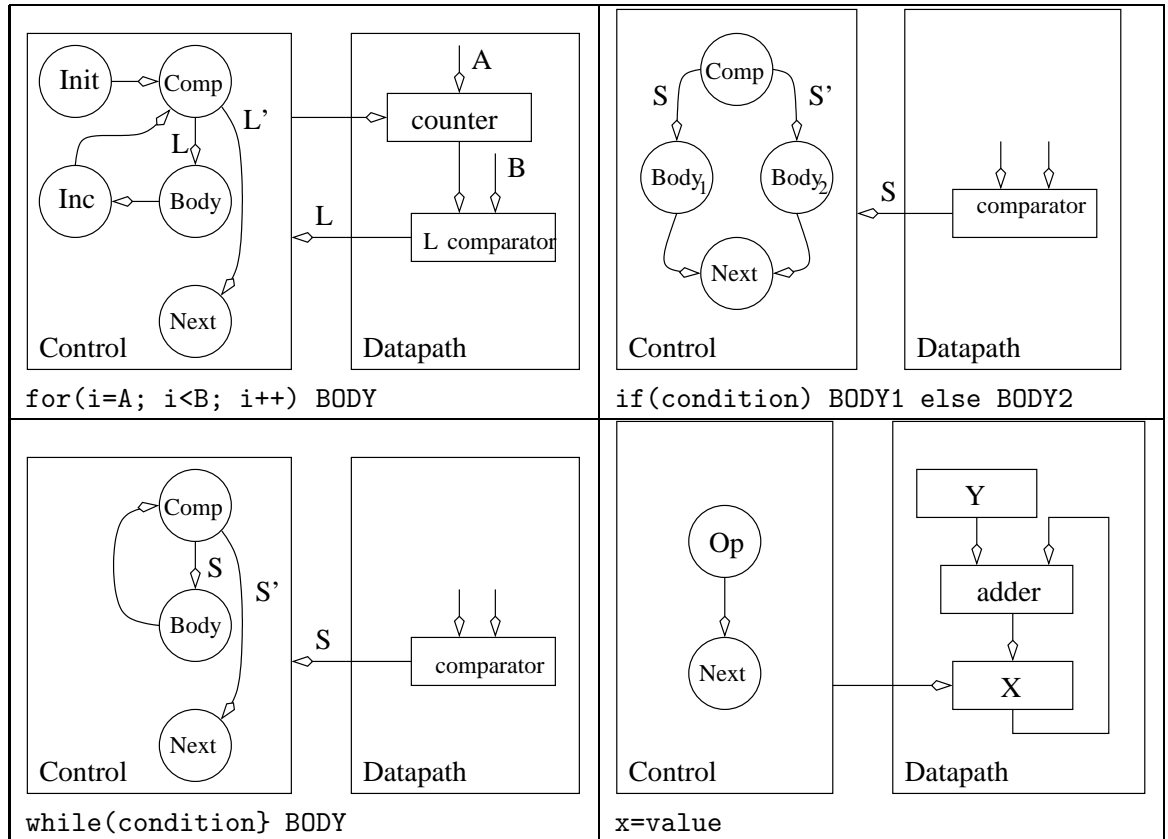


Mini-C statements

- if (condition) then BODY₁ else BODY₂
- for (i=A; i<B; i += 1) BODY
- while(condition) BODY
- X = value

where BODY contains 0 or more statements.

Device	Data in	Data out	Status	Control
N:M Decoder	1 bit	M bits		N bits
N:1 Mux	N bits	1 bit		$\log_2(N)$ bits
MxNx1 Mux	N, each M bits	M bits		$\log_2(N)$ bits
N bit adder	2, each N bits	N bits	Overflow	
N bit add/sub	2, each N bits	N bits	Overflow	1 bit
N bit comparator	2, each N bits		3 bits	
BCD to 7-segment	4-bits	7-bits		
N-bit priority encoder	N-bits	$\log(N)$ -bits		
N bit register	N bits	N bits		1 bit
N bit shift register	N bits	N bits		2 bits
N bit counter	N bits	N bits		2 bits
Three state buffer	N bits	N bits		1 bit
N:M RAM	$\log_2(N)$ bits, M bits	M bit		3 bits
N-bit Bus transceiver	N bits	N bits		2 bit



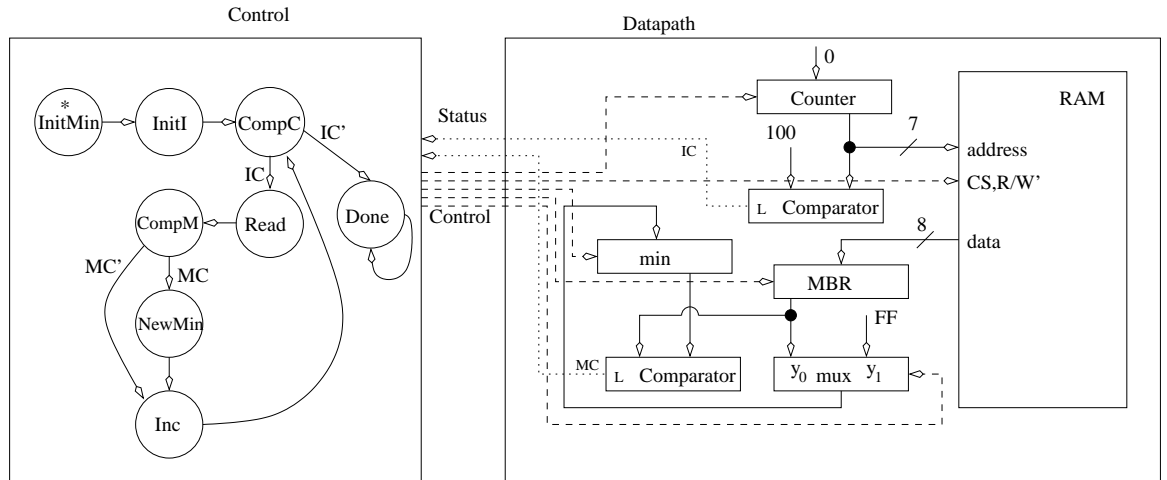
8.2 Problems

Minimum Search Design a digital circuit that looks for the smallest 8-bit integer in a 128x8 bit RAM. The numbers are stored at addresses 0...99, you may assume that the RAM is preloaded with data.

```

1. min = 0xFF;           // Set the min reg to largest value
2. for (i=0; i<100; i++) { // Search through the entire array
3.     MBR=RAM[i];       // read an 8-bit value from the RAM
4.     if (MBR<min) then // If MBR is smaller than min
5.         min = MBR;    // then set min to the smallest value
6. } // end for

```

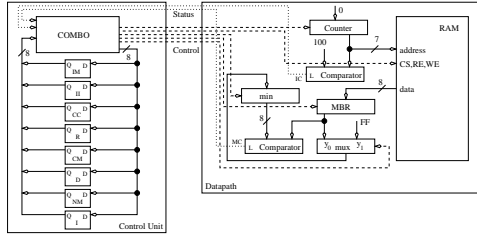


State	CS	RE	WE	Reg Min	Min mux	Counter	MBR
	0 off	0 idle	0 idle	0 hold	0 load FF	00 hold	0 hold
	1 active	1 read	1 write	1 load	1 load RAM	01 load	1 load
						10 count	
						11 reset	
InitMin							
InitI							
CompC							
Read							
CompM							
NewMin							
Inc							
Done							

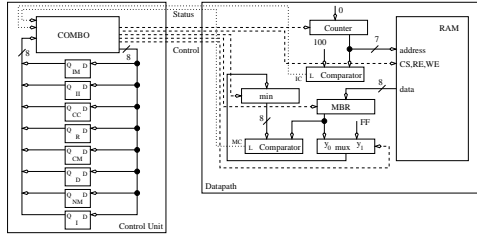
$Q_{IM} =$
 $Q_{II} =$
 $Q_{CC} =$
 $Q_R =$
 $Q_{CM} =$
 $Q_{NM} =$
 $Q_I =$
 $Q_D =$

$Z_{CS} =$
 $Z_{RE} =$
 $Z_{WE} =$
 $Z_{RM} =$
 $Z_{MM} =$
 $Z_{C1} =$
 $Z_{C0} =$
 $Z_{MBR} =$

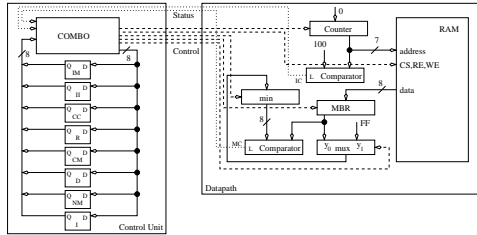
Shade the active FF and any BBBs which are read or written.



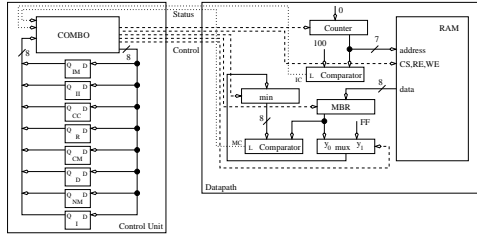
1. State **InitMin**



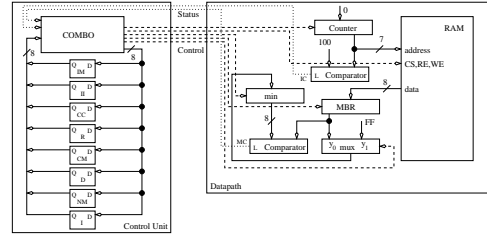
2. State **InitI**



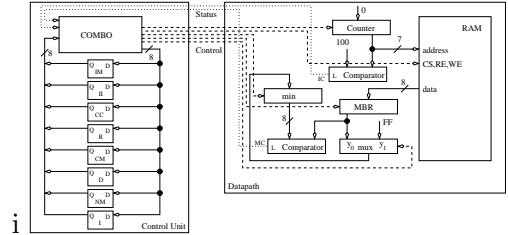
3. State **CompC**



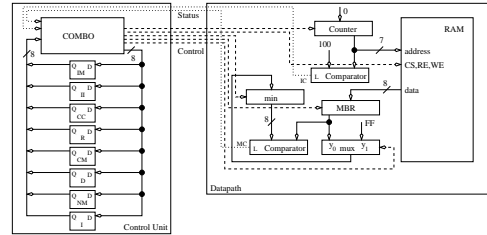
4. State **Read**



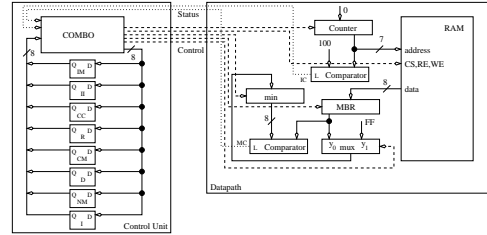
5. State **CompM**



6. State **NewMin**



7. State **Inc**



8. State **CompC**