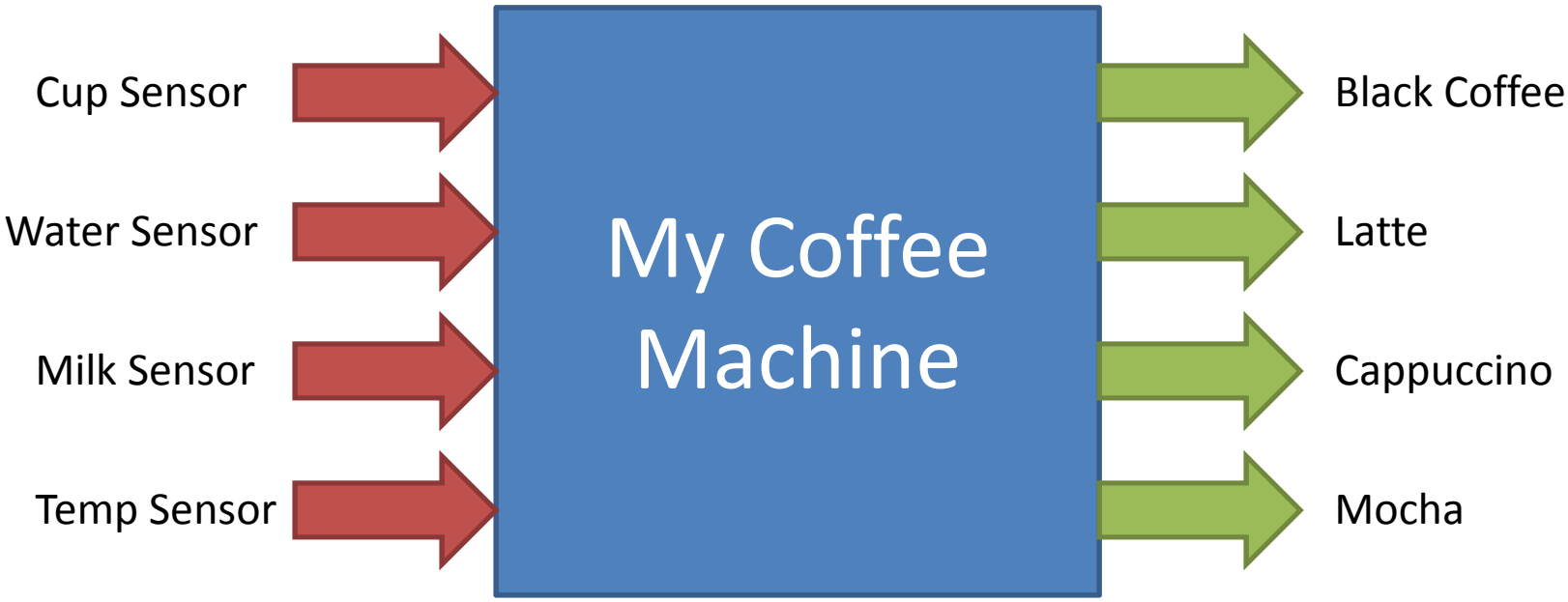
Multi State Machines

The Simple Coffee Machine Controller Using the MSP430

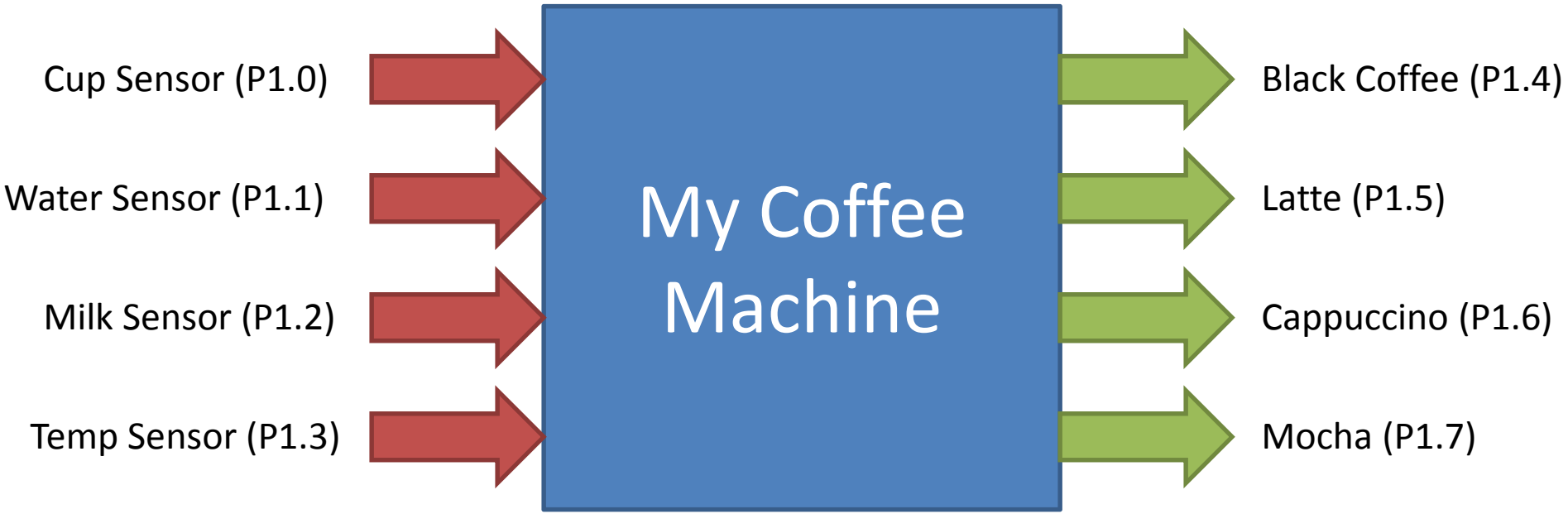
Understand the I/O of System

Define the I/O of System – According to design Specifications

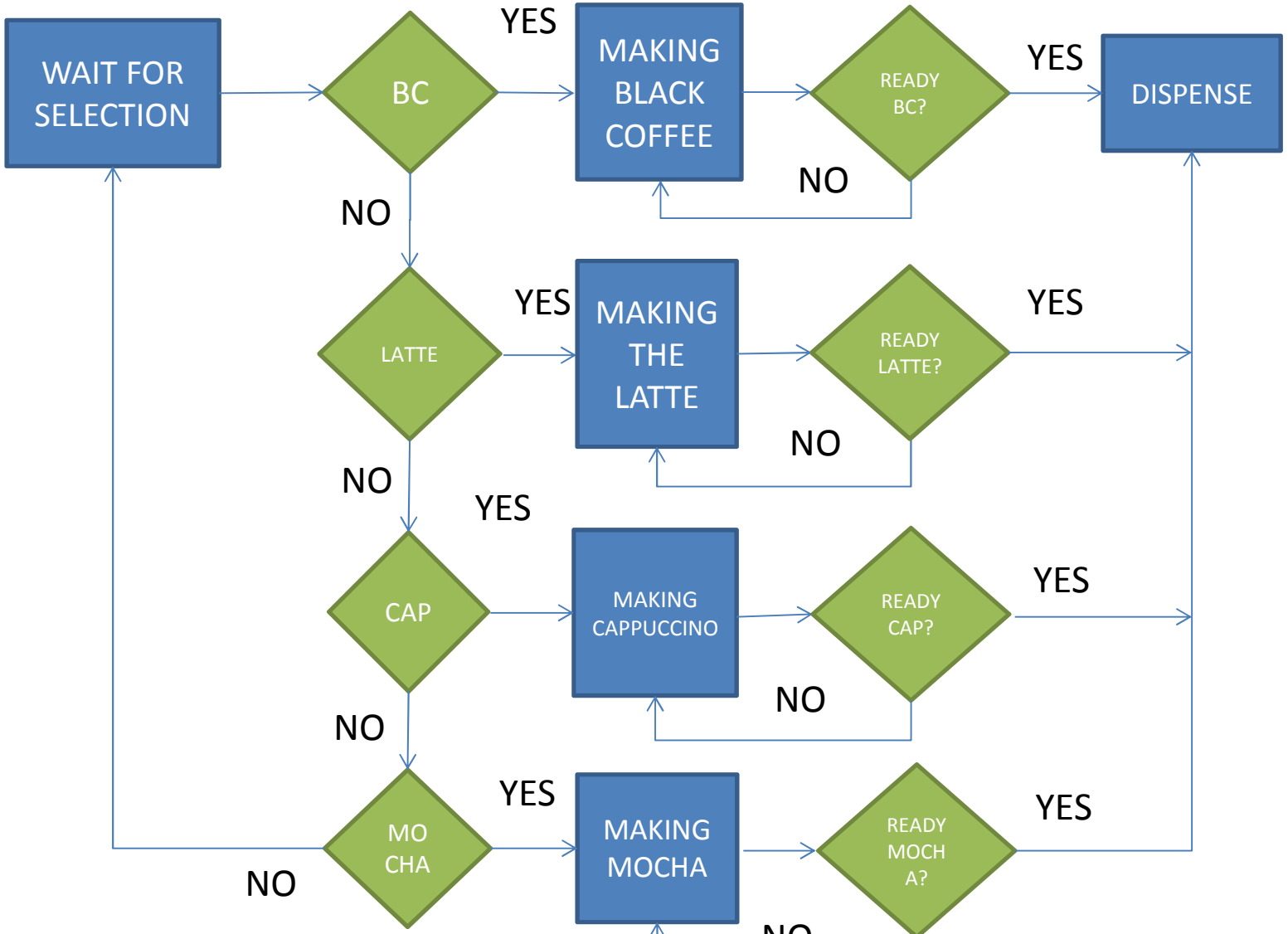


Coffee Example

Assign the I/O of System by The hardware you will use



Simple Flowchart – 6 States



Simple Flowchart to Simple Program

- 6 states => 6 enumerations (enum's)

```
typedef enum {Wait, BC, Latte, Cap, Mocha, Dispense} Drink;
```

  - Typedef enum => defining a type with enumerations
  - {…} => Enum names that are type "Drink"
  - Drink => The "type" in which defines the {….} names

- Use Switch-Case format to follow state execution
- Also, assume the user's choice of drink by using the following:

  - P2.0 => Black Coffee (BC) button
  - P2.1 => Latte (Latte) button
  - P2.2 => Cappuccino (CAP) button
  - P2.3 => Mocha (MOCHA) button

Simple Flowchart to Simple Program

```
typedef enum {Wait, BC, Latte, Cap, Mocha, Dispenser} Drink;

int main(void) {

    WDTCTL = WDTPW | WDTHOLD;  // Stop watchdog timer
    P1DIR = 0xF0;              // Output signals to different drinks
    P1OUT = 0x00;              // Initial state should be just waiting
    P2DIR = 0x00;              // P2 Direction -- All inputs -- READ User's choice

    P2REN |= 0x0F;             // ENABLE Buttons when User makes a choice
    P2SEL &= 0x0F;             // Selection buttons, 0-logic selects
    P2OUT = 0x0F;              // Keep buttons to HIGH LOGIC

    Drink cafe = Wait;         // defined & initialized the variable 'cafe' to Wait
```

Simple Flowchart to Simple Program (Cont.)

```
while(1) {                                  // always execute Coffee Machine
switch(cafe) {                              // analyzing variable 'cafe' as the CURRENT-STATE
  case Wait:
    if((P2IN & 0x0F)== 0x0E)   {            // User selects Black Coffee (1111 to 1110 P2.0)?
        cafe = BC;                          // If true, change state from Wait to BC
    }
    if((P2IN & 0x0F) == 0x0D) {             // User selects Black Coffee (1111 to 1101 P2.1)?
        cafe = Latte;                       // If true, change state from Wait to Latte
    }
    if((P2IN & 0x0F) == 0x0B) {             // User selects Black Coffee (1111 to 1011 P2.2)?
        cafe = Cap;                         // If true, change state from Wait to Cap
    }
    if((P2IN & 0x0F) == 0x07) {             // User selects Black Coffee (1111 to 0111 P2.3)?
        cafe = Mocha;                       // If true, change state from Wait to Mocha
     }
    break;                                  // break from case, keep state = Wait
```

Simple Flowchart to Simple Program (Cont.)

```
case BC:                                  // Black Coffee case
 if(P1IN == 0x0B){                        // If (P1.0 & P1.1 & P1.3) Cup, Water & Temp are true
        cafe = Dispenser;                 // if true, start dispensing
        break;                            // move state = Dispenser
  }
   LCDdisplay("Making Coffee");           // message to user using LCD with its function
  break;                                  // if not ready, keep making coffee & state = BC
//=========================================================================
case Latte:                               // Latte Case
  if(P1IN == 0x0F){                       // if (P1.0 to P1.3) are true
        cafe = Dispenser;                 // if true, start dispensing
        break;                            // move state = Dispenser
  }
  LCDdisplay("Making Latte");             // message to user using LCD with its function
  break;                                  // if not ready, keep making coffee & state = Latte
```

Simple Flowchart to Simple Program (Cont.)

```
case Cap:
 if(P1IN == 0x0D){                  // If (P1.0 & P1.2 & P1.3) Cup, Milk & Temp are true
        cafe = Dispenser;           // if true, start dispensing
        break;                      // move state = Dispenser
   }
 LCDdisplay("Making Cappu..");      // message to user using LCD with its function
  break;                            // if not ready, keep making coffee & state = Cap
//=====================================================================
case Mocha:
   if(P1IN == 0x0F){                // If (P1.0 to P1.3) same as Latte (Rip off!!)
        cafe = Dispenser;           // if true, start dispensing
        break;                      // move state = Dispenser
   }
 LCDdisplay("Making Mocha");        // message to user using LCD with its function
 break;                             // if not ready, keep making coffee & state = Mocha
```

Simple Flowchart to Simple Program (Cont.)

```
case Dispenser:
   LCDdisplay("Dispensing now");          // message to user using LCD with its function
            DispenseFunc();               // dispense function
            timeDelay();                  // amount of time dispensing drink
            cafe = Wait;                  // change state back to Wait
    }                                     // end of SWITCH-CASE
//=============================================================================
   }                                      // end of While loop
}                                         // end of MAIN
```