

QUESTION 1

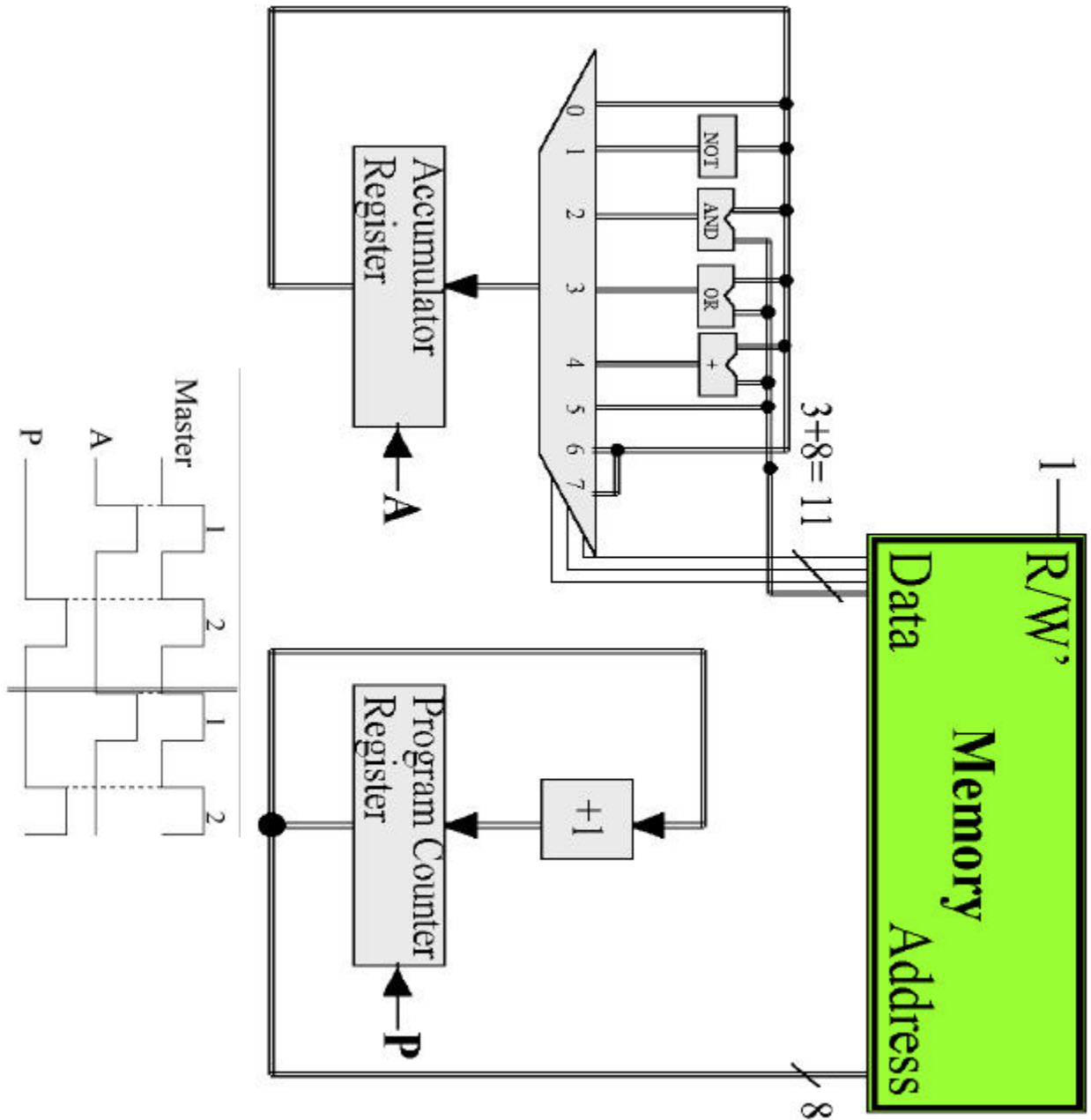
CPU Design

(2 + 12 = 14 points)

Consider the following CPU.

Change the CPU design **BY DRAWING OVER** the diagram to modify:

- Opcode 7 should clear the Accumulator:  
Accum. := 0
  - Opcode 6 should implement an unconditional branch:  
PC := PC + Accum.
- (Accumulator remains unchanged)



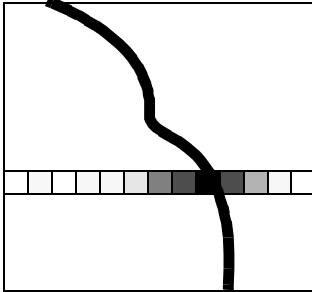
QUESTION 2

IMAGE SENSOR

(10 points)

Implement an image processing routine that analyses a **single gray level image line** which can be part of a program to drive a robot along a line marking on the ground:

Write a program to find the darkest spot in a given image line.



Pixel values: white (255), black (0)

- **Implement C function** `int find_line(line l);`
- This function should **return the position** (range: 0..79) of the **darkest pixel** in the line, **provided** that gray value is lower than the threshold, **otherwise** return -1
- If there are several pixels with the lowest bightness value below threshold, return either one's position.

```
#define IMAGEROWS    60
#define IMAGECOLUMNS 80
#define THRESHOLD    50
typedef BYTE image[imagecolumns][imagerows];
typedef BYTE line [imagecolumns];
```

```
int find_line(line l)
{
```