CSE 324 Embedded Systems – Spring 2024
Homework I

Zyad Tarik Awad Omar 120210275

Question 1

A 512-memory chip has 8 pins for data. Find: (a) The organization, and (b) The number of address pins for this memory chip.

(a) The organization is 64x8 because there are 8 bins for data and a total of 512.

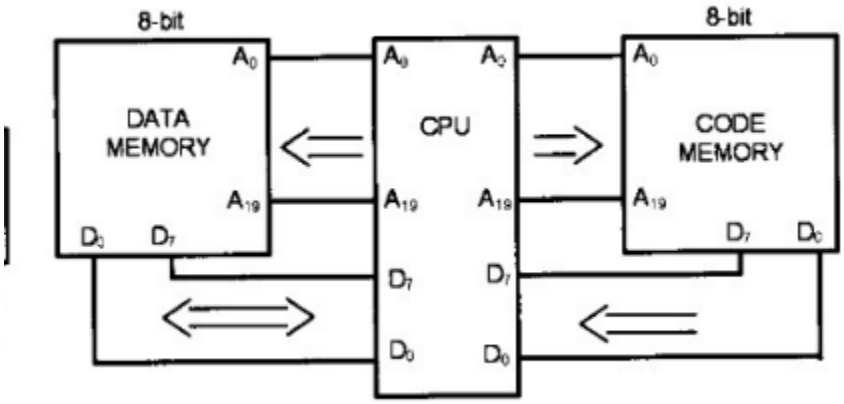
(b) The number of address pins can be calculated as follows: there are 64 possible addresses, meaning that it would take 2^6 digits, meaning that it would take **6** address pins for this memory chip.

Question 2

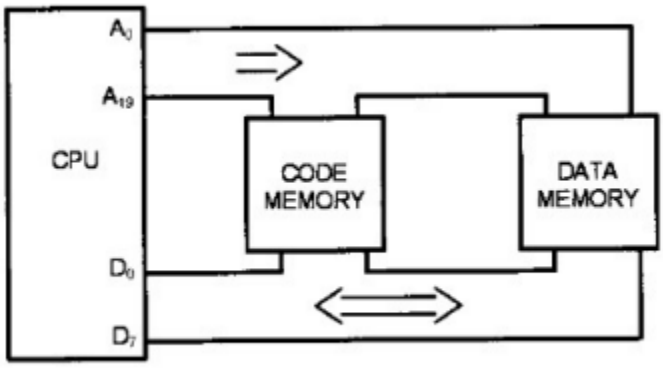
For ROM chip 27128 has a capacity of 128 K bits with 16K x 8 organization. Find the number of data and address pins.

- The number of data bins is **8** since it is 16kx8.
- The number of address pins is $log_2(16k)$ which is **14** address pins

Question 3



(a) Harvard Architecture
This is the harvard architecture because it has different storage and signal pathways for the data and instructions.



(b) von-Neuman Architecture
This is the von-Neuman architecture because it has connected signal pathways.

Question 4

(a) 12 / 2 = 6 => 0
6 / 2 = 3 => 0
3 / 2 = 1 => 1
1 / 2 = 0 => 1
12 => 1100

(b) 123 / 2 = 61 => 1
61 / 2 = 30 => 1
30 / 2 = 15 => 0
15 / 2 = 7 => 1
7 / 2 = 3 => 1
3 / 2 = 1 => 1
1 / 2 = 0 => 1
61 => 1111011

(c) 63 / 2 = 31 => 1
31 / 2 = 15 => 1
15 / 2 = 7 => 1
7 / 2 = 3 => 1
3 / 2 = 1 => 1
1 / 2 = 0 => 1
63 => 111111

(d) 128 / 2 = 64 => 0
64 / 2 = 32 => 0
32 / 2 = 16 => 0
16 / 2 = 8 => 0
8 / 2 = 4 => 0
4 / 2 = 2 => 0
2 / 2 = 1 => 0
1 / 2 = 0 => 1
128 => 10000000

(e) 1000 / 2 = 500 => 0
500 / 2 = 250 => 0
250 / 2 = 125 => 0
125 / 2 = 62 => 1
62 / 2 = 31 => 0
31 / 2 = 15 => 1
15 / 2 = 7 => 1
7 / 2 = 3 => 1
3 / 2 = 1 => 1
1 / 2 = 0 => 1
1000 => 1111101000

Question 5

LDI r20, 4 => No change LDI doesn't affect the zero flag
DEC r20 => No change still not zero
DEC r20 => No change still not zero
DEC r20 => No change still not zero
DEC r20 => sets the Z flag

Question 6

LDI R20, 0x9C
LDI R21, 0x64
ADD R20, R21
The addition sets the C, H and Z flags.

Question 7

The code results in an error as the ADD command is used only with registers.

Question 8

LDI R16, 200 => 1 cycle
BACK: LDI R18, 100 => 1 cycle * 200 times
HERE: NOP => 1 cycle * 100 times * 200 times
DEC R18 => 1 cycle * 100 times * 200 times
BRNE HERE => 2 cycles * 99 times * 200 times and 1 cycle * 200 times
DEC R16 => 1 cycle * 200 times
BRNE BACK => 2 cycles * 199 times and 1 cycle * 1 time
The total count of Cycles is 80600
Given that the frequency is 8 MHZ
that means the cycle takes $\frac{1}{8*10^6}$ to run
so The total time count is $80600 \times \frac{1}{8*10^6} = 10.075$ microseconds