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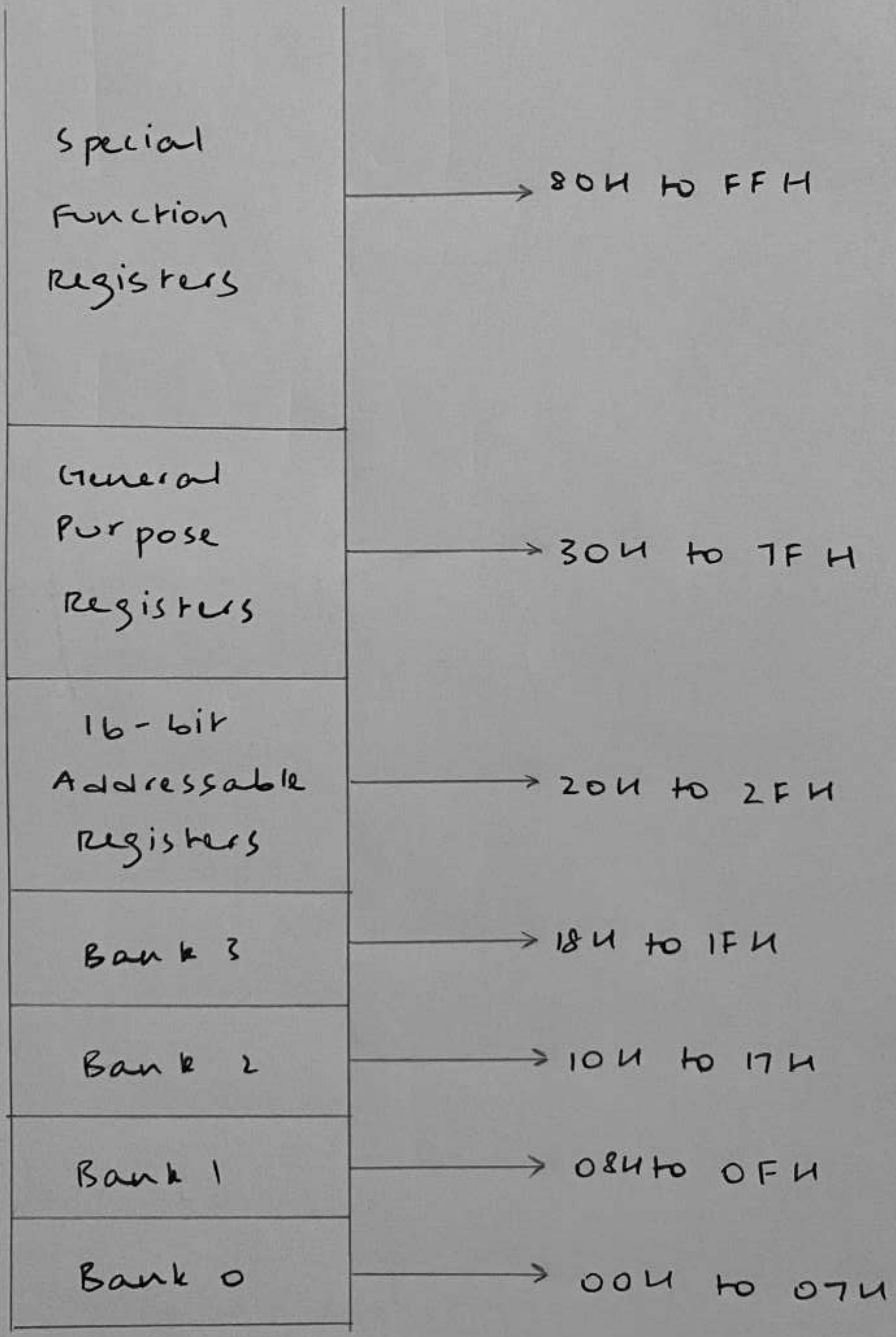
21BDS0340

Digital Assignment - 1

1.



The memory in 8051 is divided into 2 major parts. There are register banks, 4 sets of them and scratch pad memory, denoted as general purpose

2-bits of the PSW are dedicated to denote which of the 4 register banks are in use

The second half of the internal RAM is dedicated to SFR, special function registers, which are used to program hardware peripherals.

2. Program Status word, PSW, are a set of 8 bits which are used directly by the 8051 microcontroller that reflect the current CPU state. 2 of the 8 bits in the PSW are user definable

The following is the explanation of each bit:

Carry Flag (CY)

The carry flag is there to denote a carry of any kind from arithmetic operations

Auxilliary Carry Flag (AC)

The auxilliary carry flag is used when the CPU performs multiplication or division to store the 4-bit carry

Flag 0 (F0)

This bit is made for user purposes

Register Bank selector 1 and 0 (RS1, RS0)

These bits are set to select the current active register bank (0-4)

Overflow flag (OV)

The overflow flag exists for when an input or calculated value is so large that it overflows into the sign bit, causing a wrong value

This register is marked for user defining

Parity flag (P)

The parity flag is used to check for errors in a 0/1 bit parity checker

3. The stack pointer on the 80 51 micro controller is a pointer that can access only internal memory on the RAM.

The accessing type is indirect and can access data from the range 00H to FFH

The initial SP value is 08H, meaning that push and pop operations start there. 08H is also the initial location of bank 1.

The user can push and pop instructions / operation codes or variables by stack pointers.

4. The various addressing modes are as follows:

→ Immediate Addressing

The data is provided in the instruction itself

Example:

```
MOV A, #03H
```

This moves the value 03H into A

Register Addressing

The data is transfered through a register instead of a direct value

Example:

```
MOV A, R5
```

This moves the value of R5 to A

Direct Addressing

The address of a register in internal memory is given

Example:

```
MOV A, 01H
```

This moves the value of 01H (R1) to A

Register Indirect Addressing

The value of a register is used as a new instruction location

Example:

```
MOV R1, @R0
```

This means that I want to take the value of R0 as a memory location itself and find the value in that register.

This method allows for the use of other banks utilisation

Indexed Addressing

The value of a register + a start. operation's value is read and moved to A

Example:

```
MOVC A, @A+PC
```

If A holds the value 10H and PC holds 50H, the value 10+50 = 60H memory location will be stored in A

Implied Addressing

These are single operand operations that only work on specific registers

5. $F = 11.0592$ MHz

timer frequency $= F/12$

$= 921.6$ kHz

$\therefore$ clock period $= \dfrac{1}{\text{timer freq.}}$

$= \dfrac{1}{921.6 \times 10^3}$

$= \underline{1.085\ \mu s}$

$\therefore$ Each machine cycle is $1.085\ \mu s$

The first line is executed once

The second to fifth lines are executed 150 times

The sixth line is executed once

$\therefore$ Total time $= (1 + 150(1+1+1+2) + 2) \times 1.085$

$= (3 + 150 \times 5) \times 1.085$

$= 753 \times 1.085$

$= \underline{817.005\ \mu s}$ or $\underline{0.817 ms}$