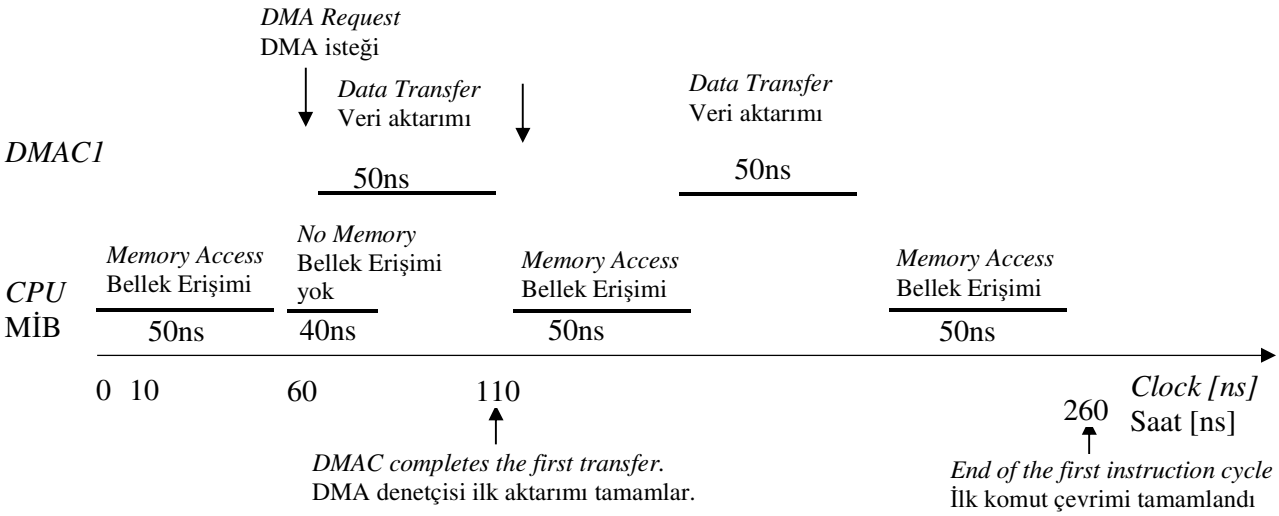
COMPUTER ARCHITECTURE 2ND MIDTERM SOLUTIONS

QUESTION 1: (40)



DMAC1 completes the first transfer at Clock = 110ns.
For the explanation, see the figure.
Clock = 50 + 10 + 50 = 110ns

DMAC1, ilk aktarımı, Saat = 110 ns'de tamamlar.
Açıklama için yukarıdaki şekle bakınız.
Saat= *50 + 10 + 50 = 110ns*

The first instruction cycle will be completed at Clock = 260ns.
For the explanation, see the figure.
Clock= 50 + 10 + 50 + 50 + 50 + 50 = 260ns

İlk komut çevrimi, Saat = 260 ns'de tamamlanır.
Açıklama için yukarıdaki şekle bakınız.
Saat= *50 + 10 + 50 + 50 + 50 + 50 = 260ns*

b) (*15 points* / 15 puan) DMAC1 has higher priority.
DMAC1 starts the first transfer at Clock =60 ns.
Because of the cycle-stealing mode, it releases the bus after the first transfer. Clock=110 ns.
DMAC2 gets the bus (DMACs have higher priority than the CPU)
DMAC2 will complete the transfer of the first word at Clock = 160ns. (110 +50 =160 ns)
The CPU will complete the first instruction after all DMA transfers have been completed.
60 + (50 + 50) x 5 + 50 + 50 = 660 ns.
The first instruction cycle will be completed at Clock = 660ns.

DMAC1'in daha yüksek önceliği vardır.
DMAC1, ilk aktarıma, Saat=60ns'de başlar.
Çevrim çalma yöntemi nedeniyle, ilk aktarımdan sonra yolu bırakır. Saat = 110 ns.
DMAC2 yolu alır (DMAC'lerin önceliği, MİB'inkinden yüksektir.)
DMAC2 ilk sözcüğün aktarımını Saat = 160 ns'de tamamlar. (110+50=160 ns)
MİB, ilk komutu, bütün DMA aktarımları yapıldıktan sonra tamamlar.
60 + (50 + 50) x 5 + 50 + 50 = 660 ns.
İlk komut çevrimi Saat = 660ns'de tamamlanır.

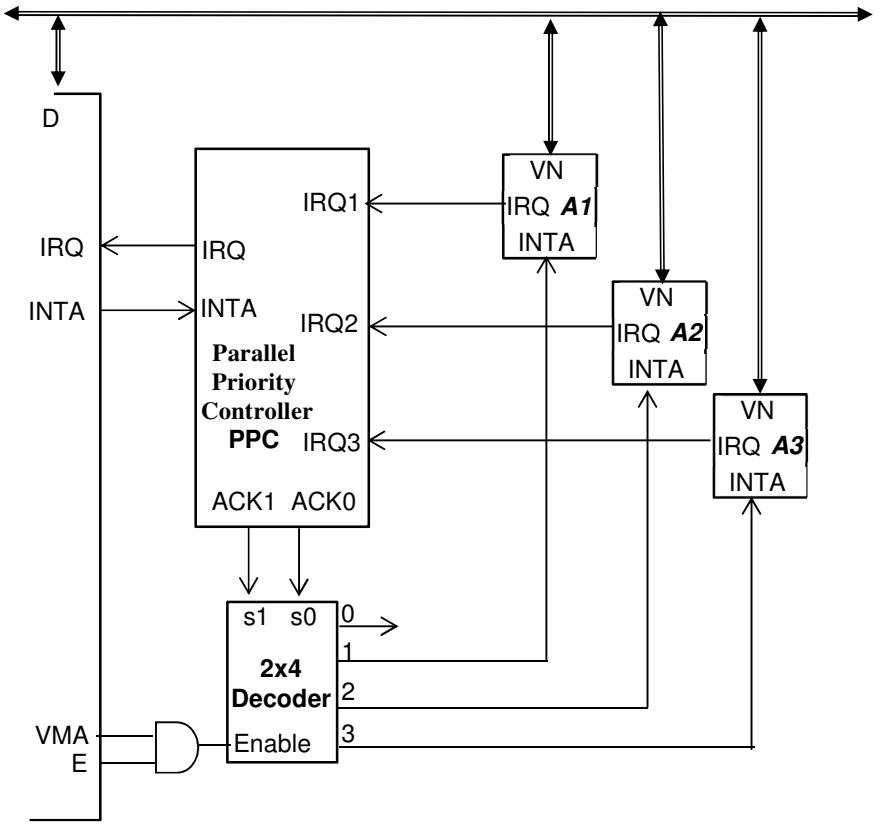
c) (*15 points* / 15 puan) DMAC1 operates in the **cycle-stealing** mode, DMAC2 operates in the **burst** mode
DMAC1 will transfer one word and release the bus (cycle stealing). Then, DMAC2 transfers all words until the word counter is zero. DMAC1 will get the bus and transfer the second word (Clock = 410 ns).
Clock= 60+ 50 + 5x50 + 50 = 410 ns

At Clock = 410 ns, the CPU gets the bus and accesses the memory for 50 ns.
At Clock = 460 ns, DMAC1 gets the bus and accesses the memory for 50 ns.
At Clock = 510 ns, the CPU gets the bus and accesses the memory for 50 ns.
At Clock = 560 ns, the CPU completes the first instruction.

DMAC1 çevrim çalma, DMAC2 blok aktarma yöntemiyle çalışmaktadır.
DMAC 1, bir sözcük aktarır ve yolu bırakır (çevrim çalma). Sonra, DMAC2, sözcük sayacı 0 oluncaya kadar, bütün sözcükleri aktarır. Bu aktarım bitince, DMAC1, yolu alır ve ikinci sözcüğü aktarır (Saat = 410 ns).
Clock= 60+ 50 + 5x50 + 50 = 410 ns

Saat = 410 ns'de, MİB, yolu alır ve 50 ns boyunca belleğe erişir.
Saat = 460 ns'de, DMAC1, yolu alır ve 50 ns boyunca belleğe erişir.
Saat = 510 ns'de, MİB, yolu alır ve 50 ns boyunca belleğe erişir.
Saat = 560 ns'de, MİB, ilk komutu tamamlar.

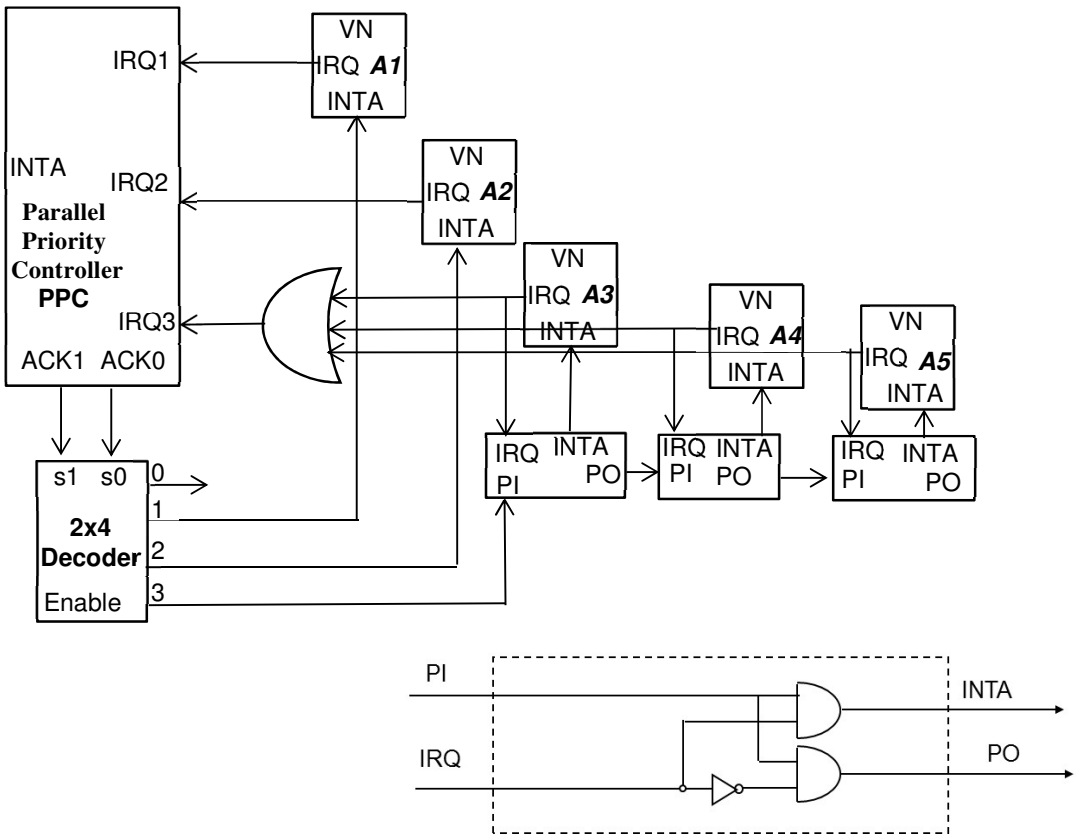
QUESTION 2: (40)
a) (15)



b) (10)

IRQ1	IRQ2	IRQ3	INTA	IRQ	ACK1	ACK0	
1	X	X	0	1	0	0	Not accepted
1	X	X	1	1	0	1	From IRQ1
0	1	X	0	1	0	0	Not accepted
0	1	X	1	1	1	0	From IRQ2
0	0	1	0	1	0	0	Not accepted
0	0	1	1	1	1	1	From IRQ3
0	0	0	X	0	0	0	No request

c) (15)



It is also possible to create to chains in different ways.
For example; A1, (A2,A3), (A4,A5)
Zincirler farklı şekillerde de oluşturulabilir.
Örneğin; A1, (A2,A3), (A4,A5)

QUESTION 3: (20)

a) The average seek time is

$$avg.seek\ time = \frac{1}{2} \cdot (time\ for\ head\ to\ move\ between\ tracks\ having\ maximum\ possible\ separation\ )$$

Since there are 10,000 tracks, there are (10,000 - 1) = 9999 separations between the innermost and the outermost tracks. It takes 0.002 ms to move over each separation. So,

$$avg.seek\ time = \frac{1}{2} \cdot (10{,}000 - 1) \times 0.002ms$$

$$= 9.999\ ms$$

This solution is also accepted:

$$avg.seek\ time = \frac{1}{2} \cdot (10{,}000) \times 0.002ms$$

$$= 10\ ms$$

b) In the problem statement, it is given that the worst-case rotational latency of the disk is 6 ms. So,

$$T_r = \frac{60}{RPM} = 6\ ms$$

Solving for RPM,

$$RPM = \frac{60}{T_r} = \frac{60}{0.006s} = 10{,}000\ revolutions/minute$$