CSE331 Computer Organization HW2 Report

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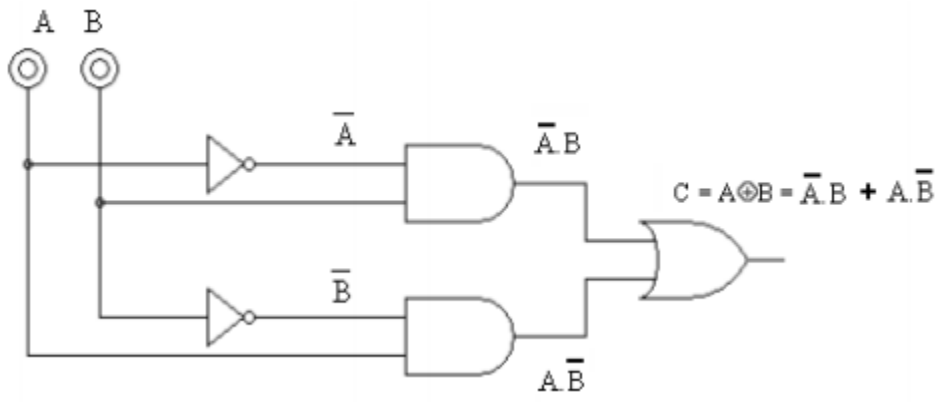
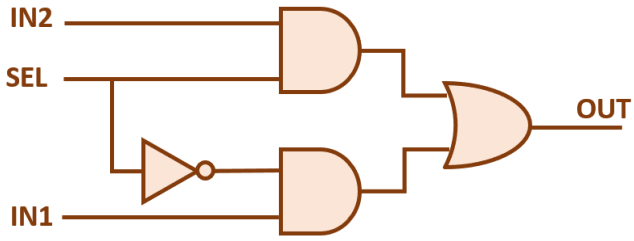
Tasarımda kullanılan yapıların logic şemaları

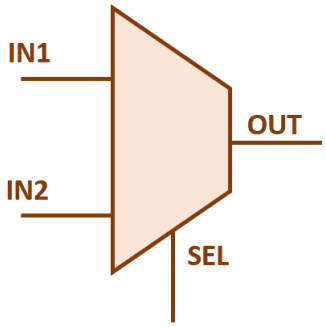
My_Xor:




```
# time =  0, a=0, b=0, c=0
# time = 20, a=0, b=1, c=1
# time = 40, a=1, b=1, c=0
# time = 60, a=1, b=0, c=1
```

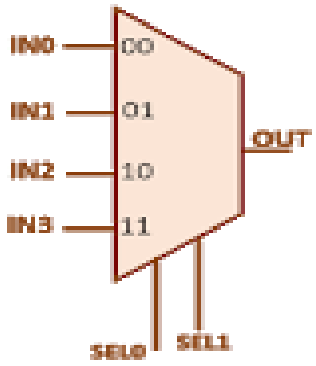
2x1 Mux:

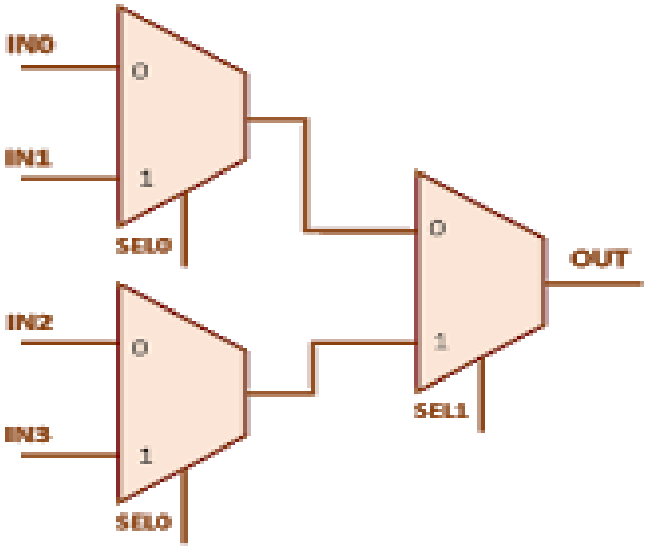





```
# time =  0, a=0, b=0, s=0, c=0
# time = 20, a=0, b=1, s=0, c=0
# time = 40, a=1, b=1, s=0, c=1
# time = 60, a=1, b=0, s=0, c=1
# time = 80, a=0, b=0, s=1, c=0
# time = 100, a=0, b=1, s=1, c=1
# time = 120, a=1, b=1, s=1, c=1
# time = 140, a=1, b=0, s=1, c=0
```

4x1 Mux:

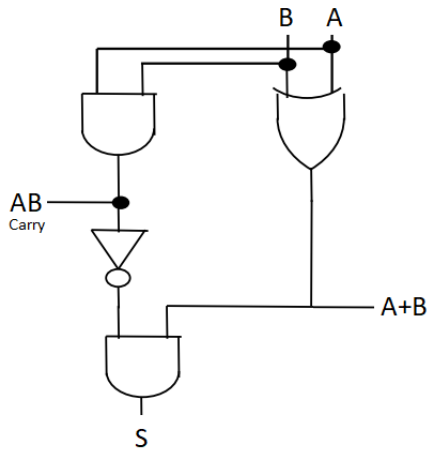





```
# time =  0, a=0, b=0, c=0, d=0, sl=0, s0=0, e=0
# time = 20, a=0, b=0, c=0, d=1, sl=0, s0=0, e=0
# time = 40, a=0, b=0, c=1, d=0, sl=0, s0=0, e=0
# time = 60, a=0, b=0, c=1, d=1, sl=0, s0=0, e=0
# time = 80, a=0, b=1, c=0, d=0, sl=0, s0=0, e=0
# time = 100, a=0, b=1, c=0, d=1, sl=0, s0=0, e=0
# time = 120, a=0, b=1, c=1, d=0, sl=0, s0=0, e=0
# time = 140, a=0, b=1, c=1, d=1, sl=0, s0=0, e=0
# time = 160, a=1, b=0, c=0, d=0, sl=0, s0=0, e=1
# time = 180, a=1, b=0, c=0, d=1, sl=0, s0=0, e=1
# time = 200, a=1, b=0, c=1, d=0, sl=0, s0=0, e=1
# time = 220, a=1, b=0, c=1, d=1, sl=0, s0=0, e=1
# time = 240, a=1, b=1, c=0, d=0, sl=0, s0=0, e=1
# time = 260, a=1, b=1, c=0, d=1, sl=0, s0=0, e=1
# time = 280, a=1, b=1, c=1, d=0, sl=0, s0=0, e=1
# time = 300, a=1, b=1, c=1, d=1, sl=0, s0=0, e=1
# time = 320, a=0, b=0, c=0, d=0, sl=0, s0=1, e=0
# time = 340, a=0, b=0, c=0, d=1, sl=0, s0=1, e=0
# time = 360, a=0, b=0, c=1, d=0, sl=0, s0=1, e=0
# time = 380, a=0, b=0, c=1, d=1, sl=0, s0=1, e=0
# time = 400, a=0, b=1, c=0, d=0, sl=0, s0=1, e=1
# time = 420, a=0, b=1, c=0, d=1, sl=0, s0=1, e=1
# time = 440, a=0, b=1, c=1, d=0, sl=0, s0=1, e=1
# time = 460, a=0, b=1, c=1, d=1, sl=0, s0=1, e=1
# time = 480, a=1, b=0, c=0, d=0, sl=0, s0=1, e=0
# time = 500, a=1, b=0, c=0, d=1, sl=0, s0=1, e=0
# time = 520, a=1, b=0, c=1, d=0, sl=0, s0=1, e=0
# time = 540, a=1, b=0, c=1, d=1, sl=0, s0=1, e=0
# time = 560, a=1, b=1, c=0, d=0, sl=0, s0=1, e=1
# time = 580, a=1, b=1, c=0, d=1, sl=0, s0=1, e=1
# time = 600, a=1, b=1, c=1, d=0, sl=0, s0=1, e=1
# time = 620, a=1, b=1, c=1, d=1, sl=0, s0=1, e=1
```

```
# time = 640, a=0, b=0, c=0, d=0, sl=1, s0=0, e=0
# time = 660, a=0, b=0, c=0, d=1, sl=1, s0=0, e=0
# time = 680, a=0, b=0, c=1, d=0, sl=1, s0=0, e=1
# time = 700, a=0, b=0, c=1, d=1, sl=1, s0=0, e=1
# time = 720, a=0, b=1, c=0, d=0, sl=1, s0=0, e=0
# time = 740, a=0, b=1, c=0, d=1, sl=1, s0=0, e=0
# time = 760, a=0, b=1, c=1, d=0, sl=1, s0=0, e=1
# time = 780, a=0, b=1, c=1, d=1, sl=1, s0=0, e=1
# time = 800, a=1, b=0, c=0, d=0, sl=1, s0=0, e=0
# time = 820, a=1, b=0, c=0, d=1, sl=1, s0=0, e=0
# time = 840, a=1, b=0, c=1, d=0, sl=1, s0=0, e=1
# time = 860, a=1, b=0, c=1, d=1, sl=1, s0=0, e=1
# time = 880, a=1, b=1, c=0, d=0, sl=1, s0=0, e=0
# time = 900, a=1, b=1, c=0, d=1, sl=1, s0=0, e=0
# time = 920, a=1, b=1, c=1, d=0, sl=1, s0=0, e=1
# time = 940, a=1, b=1, c=1, d=1, sl=1, s0=0, e=1
# time = 960, a=0, b=0, c=0, d=0, sl=1, s0=1, e=0
# time = 980, a=0, b=0, c=0, d=1, sl=1, s0=1, e=1
# time = 1000, a=0, b=0, c=1, d=0, sl=1, s0=1, e=0
# time = 1020, a=0, b=0, c=1, d=1, sl=1, s0=1, e=1
# time = 1040, a=0, b=1, c=0, d=0, sl=1, s0=1, e=0
# time = 1060, a=0, b=1, c=0, d=1, sl=1, s0=1, e=1
# time = 1080, a=0, b=1, c=1, d=0, sl=1, s0=1, e=0
# time = 1100, a=0, b=1, c=1, d=1, sl=1, s0=1, e=1
# time = 1120, a=1, b=0, c=0, d=0, sl=1, s0=1, e=0
# time = 1140, a=1, b=0, c=0, d=1, sl=1, s0=1, e=1
# time = 1160, a=1, b=0, c=1, d=0, sl=1, s0=1, e=0
# time = 1180, a=1, b=0, c=1, d=1, sl=1, s0=1, e=1
# time = 1200, a=1, b=1, c=0, d=0, sl=1, s0=1, e=0
# time = 1220, a=1, b=1, c=0, d=1, sl=1, s0=1, e=1
# time = 1240, a=1, b=1, c=1, d=0, sl=1, s0=1, e=0
# time = 1260, a=1, b=1, c=1, d=1, sl=1, s0=1, e=1
```

Half Adder:




```
# time =  0, a=0, b=0, aorb=0, s=0, c=0
# time = 20, a=0, b=1, aorb=1, s=1, c=0
# time = 40, a=1, b=0, aorb=1, s=1, c=0
# time = 60, a=1, b=1, aorb=1, s=0, c=1
```

Projedeki ALU'lar aşağıdaki kodlar ile ilgili işlemleri gerçekleştirmektedir.

ALUOp | Function

000 | AND

001 | OR

010 | ADD

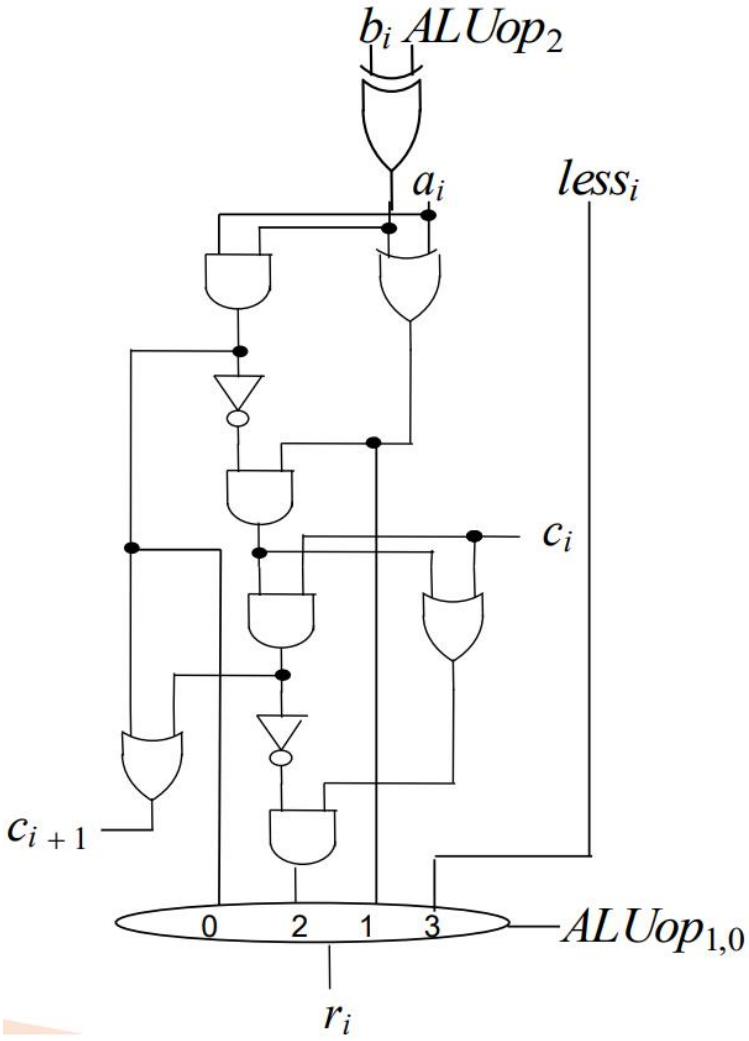
110 | SUBTRACT

111 | SET-ON-LESS-THAN

Yapılan Tasarımlarda Toplam Kullanılan Logic Kapı Sayıları

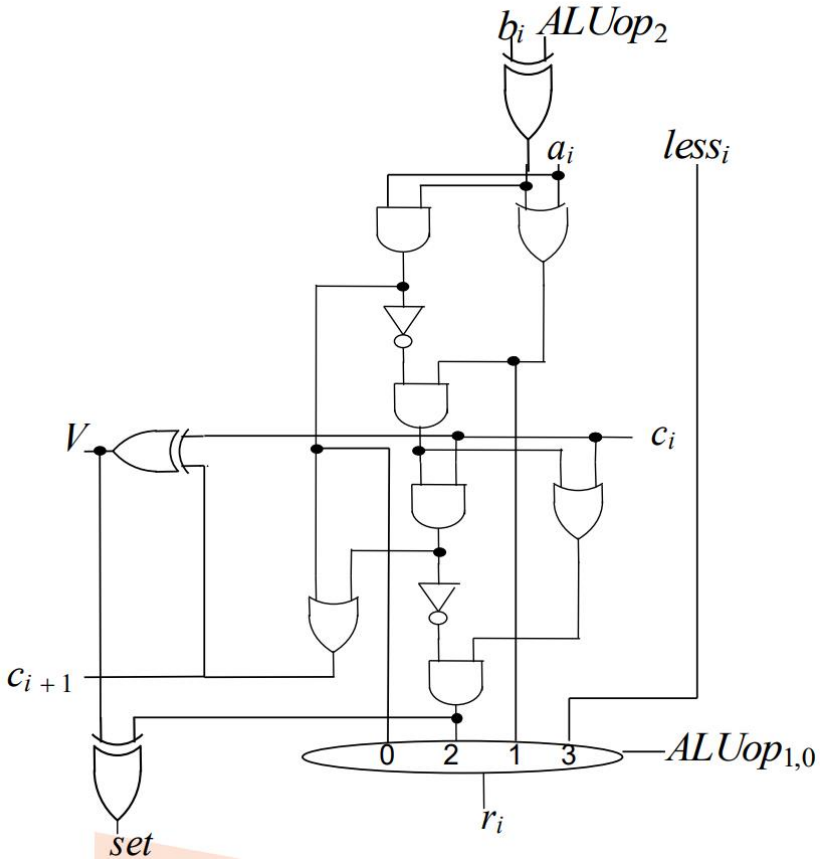
	AND	OR	NOT	TOPLAM
my_xor.v	2	1	2	***5***
mux2x1.v	2	1	1	***4***
mux4x1.v	6	3	3	***12***
half_adder.v	2	1	1	***4***
onebit_alu.v	12	7	7	***26***
onebit_alu_msb.v	16	9	11	***36***
four_bit_alu.v	52	33	31	***116***
thirty_two_bit_alu.v	388	197	167	***752***

1-Bit ALU:



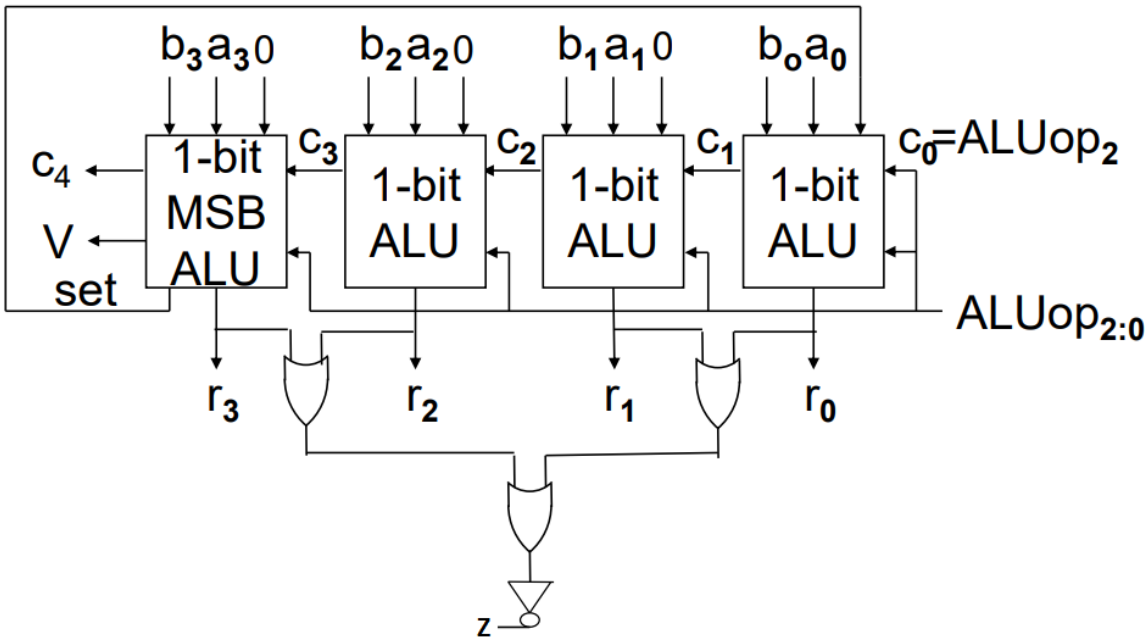

```
# time =  0, a=0, b=0, cin=0, l=0, alu_op=000 r=0, cout=0,
# time = 20, a=0, b=0, cin=0, l=0, alu_op=001 r=0, cout=0,
# time = 40, a=0, b=0, cin=0, l=0, alu_op=010 r=0, cout=0,
# time = 60, a=0, b=0, cin=0, l=0, alu_op=110 r=1, cout=0,
# time = 80, a=0, b=0, cin=0, l=1, alu_op=111 r=1, cout=0,
# time = 100, a=0, b=1, cin=0, l=0, alu_op=000 r=0, cout=0,
# time = 120, a=0, b=1, cin=0, l=0, alu_op=001 r=1, cout=0,
# time = 140, a=0, b=1, cin=0, l=0, alu_op=010 r=1, cout=0,
# time = 160, a=0, b=1, cin=0, l=0, alu_op=110 r=0, cout=0,
# time = 180, a=0, b=1, cin=0, l=1, alu_op=111 r=1, cout=0,
# time = 200, a=1, b=0, cin=0, l=0, alu_op=000 r=0, cout=0,
# time = 220, a=1, b=0, cin=0, l=0, alu_op=001 r=1, cout=0,
# time = 240, a=1, b=0, cin=0, l=0, alu_op=010 r=1, cout=0,
# time = 260, a=1, b=0, cin=0, l=0, alu_op=110 r=0, cout=1,
# time = 280, a=1, b=0, cin=0, l=1, alu_op=111 r=1, cout=1,
# time = 300, a=1, b=1, cin=0, l=0, alu_op=000 r=1, cout=1,
# time = 320, a=1, b=1, cin=0, l=0, alu_op=001 r=1, cout=1,
# time = 340, a=1, b=1, cin=0, l=0, alu_op=010 r=0, cout=1,
# time = 360, a=1, b=1, cin=0, l=0, alu_op=110 r=1, cout=0,
# time = 380, a=1, b=1, cin=0, l=1, alu_op=111 r=1, cout=0,
```

1-Bit ALU MSB:



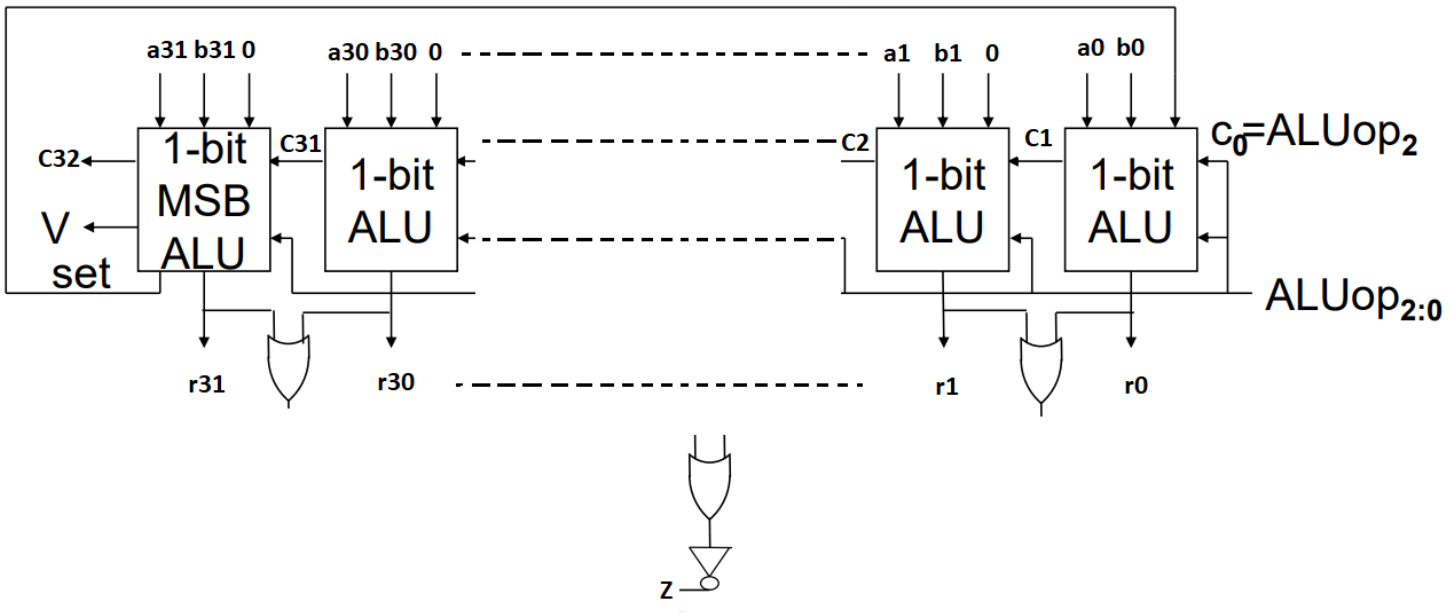

```
# time =  0, a=0, b=0, cin=0, l=0, alu_op=000 r=0, cout=0, v=0, set=0,
# time = 20, a=0, b=0, cin=0, l=0, alu_op=001 r=0, cout=0, v=0, set=0,
# time = 40, a=0, b=0, cin=0, l=0, alu_op=010 r=0, cout=0, v=0, set=0,
# time = 60, a=0, b=0, cin=0, l=0, alu_op=110 r=1, cout=0, v=0, set=1,
# time = 80, a=0, b=0, cin=0, l=1, alu_op=111 r=1, cout=0, v=0, set=1,
# time = 100, a=0, b=1, cin=0, l=0, alu_op=000 r=0, cout=0, v=0, set=1,
# time = 120, a=0, b=1, cin=0, l=0, alu_op=001 r=1, cout=0, v=0, set=1,
# time = 140, a=0, b=1, cin=0, l=0, alu_op=010 r=1, cout=0, v=0, set=1,
# time = 160, a=0, b=1, cin=0, l=0, alu_op=110 r=0, cout=0, v=0, set=0,
# time = 180, a=0, b=1, cin=0, l=1, alu_op=111 r=1, cout=0, v=0, set=0,
# time = 200, a=1, b=0, cin=0, l=0, alu_op=000 r=0, cout=0, v=0, set=1,
# time = 220, a=1, b=0, cin=0, l=0, alu_op=001 r=1, cout=0, v=0, set=1,
# time = 240, a=1, b=0, cin=0, l=0, alu_op=010 r=1, cout=0, v=0, set=1,
# time = 260, a=1, b=0, cin=0, l=0, alu_op=110 r=0, cout=1, v=1, set=1,
# time = 280, a=1, b=0, cin=0, l=1, alu_op=111 r=1, cout=1, v=1, set=1,
# time = 300, a=1, b=1, cin=0, l=0, alu_op=000 r=1, cout=1, v=1, set=1,
# time = 320, a=1, b=1, cin=0, l=0, alu_op=001 r=1, cout=1, v=1, set=1,
# time = 340, a=1, b=1, cin=0, l=0, alu_op=010 r=0, cout=1, v=1, set=1,
# time = 360, a=1, b=1, cin=0, l=0, alu_op=110 r=1, cout=0, v=0, set=1,
# time = 380, a=1, b=1, cin=0, l=1, alu_op=111 r=1, cout=0, v=0, set=1,
```

4-Bit ALU:




```
# time =  0, a=0000, b=0000, alu_op=000, r=0000, cout=0, z=1, v=0
# time = 20, a=0001, b=0001, alu_op=000, r=0001, cout=0, z=0, v=0
# time = 40, a=0010, b=0010, alu_op=000, r=0010, cout=0, z=0, v=0
# time = 60, a=0100, b=0100, alu_op=000, r=0100, cout=0, z=0, v=1
# time = 80, a=1000, b=1000, alu_op=000, r=1000, cout=1, z=0, v=1
# time = 100, a=0101, b=0101, alu_op=000, r=0101, cout=0, z=0, v=1
# time = 120, a=1010, b=1010, alu_op=000, r=1010, cout=1, z=0, v=1
# time = 140, a=1100, b=0011, alu_op=000, r=0000, cout=0, z=1, v=0
# time = 160, a=0110, b=1001, alu_op=000, r=0000, cout=0, z=1, v=0
# time = 180, a=1010, b=1010, alu_op=000, r=1010, cout=1, z=0, v=1
# time = 200, a=0010, b=1010, alu_op=000, r=0010, cout=0, z=0, v=0
# time = 220, a=1101, b=0011, alu_op=000, r=0001, cout=1, z=0, v=0
# time = 240, a=0110, b=1101, alu_op=000, r=0100, cout=1, z=0, v=0
# time = 260, a=1010, b=1110, alu_op=000, r=1010, cout=1, z=0, v=0
# time = 280, a=1111, b=1111, alu_op=000, r=1111, cout=1, z=0, v=0
# time = 300, a=0000, b=1111, alu_op=000, r=0000, cout=0, z=1, v=0
# time = 320, a=0000, b=0000, alu_op=001, r=0000, cout=0, z=1, v=0
# time = 340, a=0001, b=0001, alu_op=001, r=0001, cout=0, z=0, v=0
# time = 360, a=0010, b=0010, alu_op=001, r=0010, cout=0, z=0, v=0
# time = 380, a=0100, b=0100, alu_op=001, r=0100, cout=0, z=0, v=1
# time = 400, a=1000, b=1000, alu_op=001, r=1000, cout=1, z=0, v=1
# time = 420, a=0101, b=0101, alu_op=001, r=0101, cout=0, z=0, v=1
# time = 440, a=1010, b=1010, alu_op=001, r=1010, cout=1, z=0, v=1
# time = 460, a=1100, b=0011, alu_op=001, r=1111, cout=0, z=0, v=0
# time = 480, a=0110, b=1001, alu_op=001, r=1111, cout=0, z=0, v=0
# time = 500, a=1010, b=1010, alu_op=001, r=1010, cout=1, z=0, v=1
# time = 520, a=0010, b=1010, alu_op=001, r=1010, cout=0, z=0, v=0
# time = 540, a=1101, b=0011, alu_op=001, r=1111, cout=1, z=0, v=0
# time = 560, a=0110, b=1101, alu_op=001, r=1111, cout=1, z=0, v=0
# time = 580, a=1010, b=1110, alu_op=001, r=1110, cout=1, z=0, v=0
# time = 600, a=1111, b=1111, alu_op=001, r=1111, cout=1, z=0, v=0
# time = 620, a=0000, b=1111, alu_op=001, r=1111, cout=0, z=0, v=0
# time = 640, a=0000, b=0000, alu_op=010, r=0000, cout=0, z=1, v=0
# time = 660, a=0001, b=0001, alu_op=010, r=0010, cout=0, z=0, v=0
# time = 680, a=0010, b=0010, alu_op=010, r=0100, cout=0, z=0, v=0
# time = 700, a=0100, b=0100, alu_op=010, r=1000, cout=0, z=0, v=1
# time = 720, a=1000, b=1000, alu_op=010, r=0000, cout=1, z=1, v=1
# time = 740, a=0101, b=0101, alu_op=010, r=1010, cout=0, z=0, v=1
# time = 760, a=1010, b=1010, alu_op=010, r=0100, cout=1, z=0, v=1
# time = 780, a=1100, b=0011, alu_op=010, r=1111, cout=0, z=0, v=0
# time = 800, a=0110, b=1001, alu_op=010, r=1111, cout=0, z=0, v=0
# time = 820, a=1010, b=1010, alu_op=010, r=0100, cout=1, z=0, v=1
# time = 840, a=0010, b=1010, alu_op=010, r=1100, cout=0, z=0, v=0
# time = 860, a=1101, b=0011, alu_op=010, r=0000, cout=1, z=1, v=0
# time = 880, a=0110, b=1101, alu_op=010, r=0011, cout=1, z=0, v=0
# time = 900, a=1010, b=1110, alu_op=010, r=1000, cout=1, z=0, v=0
# time = 920, a=1111, b=1111, alu_op=010, r=1110, cout=1, z=0, v=0
# time = 940, a=0000, b=1111, alu_op=010, r=1111, cout=0, z=0, v=0
# time = 960, a=0000, b=0000, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 980, a=0001, b=0001, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1000, a=0010, b=0010, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1020, a=0100, b=0100, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1040, a=1000, b=1000, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1060, a=0101, b=0101, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1080, a=1010, b=1010, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1100, a=1100, b=0011, alu_op=110, r=1001, cout=1, z=0, v=0
# time = 1120, a=0110, b=1001, alu_op=110, r=1101, cout=0, z=0, v=1
# time = 1140, a=1010, b=1010, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1160, a=0010, b=1010, alu_op=110, r=1000, cout=0, z=0, v=1
# time = 1180, a=1101, b=0011, alu_op=110, r=1010, cout=1, z=0, v=0
# time = 1200, a=0110, b=1101, alu_op=110, r=1001, cout=0, z=0, v=1
# time = 1220, a=1010, b=1110, alu_op=110, r=1100, cout=0, z=0, v=0
# time = 1240, a=1111, b=1111, alu_op=110, r=0000, cout=1, z=1, v=0
# time = 1260, a=0000, b=1111, alu_op=110, r=0001, cout=0, z=0, v=0
# time = 1280, a=0000, b=0000, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1300, a=0001, b=0001, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1320, a=0010, b=0010, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1340, a=0100, b=0100, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1360, a=1000, b=1000, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1380, a=0101, b=0101, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1400, a=1010, b=1010, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1420, a=0111, b=0011, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1440, a=0110, b=0111, alu_op=111, r=0001, cout=0, z=0, v=0
# time = 1460, a=1010, b=1010, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1480, a=0010, b=0111, alu_op=111, r=0001, cout=0, z=0, v=0
# time = 1500, a=0111, b=0011, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1520, a=0110, b=0111, alu_op=111, r=0001, cout=0, z=0, v=0
# time = 1540, a=0101, b=0111, alu_op=111, r=0001, cout=0, z=0, v=0
# time = 1560, a=1111, b=1111, alu_op=111, r=0000, cout=1, z=1, v=0
# time = 1580, a=0000, b=0111, alu_op=111, r=0001, cout=0, z=0, v=0
```

32-Bit ALU




```
# time =  0, a=00000000000000000000000000000000, b=00000000000000000000000000000000, alu_op=000, r=00000000000000000000000000000000, cout=0, z=1, v=0
# time = 20, a=00000000000000000000000000000001, b=00000000000000000000000000000001, alu_op=000, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 40, a=00000000000000000000000000000010, b=00000000000000000000000000000010, alu_op=000, r=00000000000000000000000000000010, cout=0, z=0, v=0
# time = 60, a=00000000000000000000000000000100, b=00000000000000000000000000000100, alu_op=000, r=00000000000000000000000000000100, cout=0, z=0, v=0
# time = 80, a=00000000000000000000000000001000, b=00000000000000000000000000001000, alu_op=000, r=00000000000000000000000000001000, cout=0, z=0, v=0
# time = 100, a=00000000000000000000000000000101, b=00000000000000000000000000000101, alu_op=000, r=00000000000000000000000000000101, cout=0, z=0, v=0
# time = 120, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=000, r=00000000000000000000000000001010, cout=0, z=0, v=0
# time = 140, a=00000000000000000000000000001100, b=00000000000000000000000000000011, alu_op=000, r=00000000000000000000000000000000, cout=0, z=1, v=0
# time = 160, a=00000000000000000000000000000110, b=00000000000000000000000000001001, alu_op=000, r=00000000000000000000000000000000, cout=0, z=1, v=0
# time = 180, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=000, r=00000000000000000000000000001010, cout=0, z=0, v=0
# time = 200, a=00000000000000000000000000000010, b=00000000000000000000000000001010, alu_op=000, r=00000000000000000000000000000010, cout=0, z=0, v=0
# time = 220, a=00000000000000000000000000001101, b=00000000000000000000000000000011, alu_op=000, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 240, a=00000000000000000000000000000110, b=00000000000000000000000000001101, alu_op=000, r=00000000000000000000000000000100, cout=0, z=0, v=0
# time = 260, a=00000000000000000000000000001010, b=00000000000000000000000000001110, alu_op=000, r=00000000000000000000000000001010, cout=0, z=0, v=0
# time = 280, a=00100000010000000000000000000011, b=01000010000000010000000000000011, alu_op=000, r=00000000000000000000000000000011, cout=0, z=0, v=0
# time = 300, a=00000000000000000000000000000000, b=00000000000000000000000000001111, alu_op=000, r=00000000000000000000000000000000, cout=0, z=1, v=0
# time = 320, a=00000000000000000000000000000000, b=00000000000000000000000000000000, alu_op=001, r=00000000000000000000000000000000, cout=0, z=1, v=0
# time = 340, a=00000000000000000000000000000001, b=00000000000000000000000000000001, alu_op=001, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 360, a=00000000000000000000000000000010, b=00000000000000000000000000000010, alu_op=001, r=00000000000000000000000000000010, cout=0, z=0, v=0
# time = 380, a=00000000000000000000000000000100, b=00000000000000000000000000000100, alu_op=001, r=00000000000000000000000000000100, cout=0, z=0, v=0
# time = 400, a=00000000000000000000000000001000, b=00000000000000000000000000001000, alu_op=001, r=00000000000000000000000000001000, cout=0, z=0, v=0
# time = 420, a=00000000000000000000000000000101, b=00000000000000000000000000000101, alu_op=001, r=00000000000000000000000000000101, cout=0, z=0, v=0
# time = 440, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=001, r=00000000000000000000000000001010, cout=0, z=0, v=0
# time = 460, a=00000000000000000000000000001100, b=00000000000000000000000000000011, alu_op=001, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 480, a=00000000000000000000000000000110, b=00000000000000000000000000001001, alu_op=001, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 500, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=001, r=00000000000000000000000000001010, cout=0, z=0, v=0
# time = 520, a=00000000000000000000000000000010, b=00000000000000000000000000001010, alu_op=001, r=00000000000000000000000000001010, cout=0, z=0, v=0
# time = 540, a=00000000000000000000000000001101, b=00000000000000000000000000000011, alu_op=001, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 560, a=00000000000000000000000000000110, b=00000000000000000000000000001101, alu_op=001, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 580, a=00000000000000000000000000001010, b=00000000000000000000000000001110, alu_op=001, r=00000000000000000000000000001110, cout=0, z=0, v=0
# time = 600, a=00100000010000000000000000000011, b=01000010000000010000000000000011, alu_op=001, r=01100010010000001000000000000011, cout=0, z=0, v=0
# time = 620, a=00000000000000000000000000000000, b=00000000000000000000000000001111, alu_op=001, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 640, a=00000000000000000000000000000000, b=00000000000000000000000000000000, alu_op=010, r=00000000000000000000000000000000, cout=0, z=1, v=0
# time = 660, a=00000000000000000000000000000001, b=00000000000000000000000000000001, alu_op=010, r=00000000000000000000000000000010, cout=0, z=0, v=0
# time = 680, a=00000000000000000000000000000010, b=00000000000000000000000000000010, alu_op=010, r=00000000000000000000000000000100, cout=0, z=0, v=0
# time = 700, a=00000000000000000000000000000100, b=00000000000000000000000000000100, alu_op=010, r=00000000000000000000000000001000, cout=0, z=0, v=0
# time = 720, a=00000000000000000000000000001000, b=00000000000000000000000000001000, alu_op=010, r=00000000000000000000000000010000, cout=0, z=0, v=0
# time = 740, a=00000000000000000000000000000101, b=00000000000000000000000000000101, alu_op=010, r=00000000000000000000000000001010, cout=0, z=0, v=0
```

```
# time = 760, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=010, r=00000000000000000000000000010100, cout=0, z=0, v=0
# time = 780, a=00000000000000000000000000001100, b=00000000000000000000000000000011, alu_op=010, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 800, a=00000000000000000000000000001110, b=00000000000000000000000000001001, alu_op=010, r=00000000000000000000000000010111, cout=0, z=0, v=0
# time = 820, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=010, r=00000000000000000000000000010100, cout=0, z=0, v=0
# time = 840, a=00000000000000000000000000000010, b=00000000000000000000000000001010, alu_op=010, r=00000000000000000000000000001100, cout=0, z=0, v=0
# time = 860, a=00000000000000000000000000011101, b=00000000000000000000000000000011, alu_op=010, r=00000000000000000000000000010000, cout=0, z=0, v=0
# time = 880, a=00000000000000000000000000000110, b=00000000000000000000000000001101, alu_op=010, r=00000000000000000000000000010011, cout=0, z=0, v=0
# time = 900, a=00000000000000000000000000001010, b=00000000000000000000000000001110, alu_op=010, r=00000000000000000000000000011000, cout=0, z=0, v=0
# time = 920, a=00100000010000000000000000000011, b=01000010000000001000000000000011, alu_op=010, r=01100010010000001000000000000110, cout=0, z=0, v=0
# time = 940, a=00000000000000000000000000000000, b=00000000000000000000000000001111, alu_op=010, r=00000000000000000000000000001111, cout=0, z=0, v=0
# time = 960, a=00000000000000000000000000000000, b=00000000000000000000000000000000, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 980, a=00000000000000000000000000000001, b=00000000000000000000000000000001, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1000, a=00000000000000000000000000000010, b=00000000000000000000000000000010, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1020, a=00000000000000000000000000000100, b=00000000000000000000000000000100, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1040, a=00000000000000000000000000001000, b=00000000000000000000000000001000, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1060, a=00000000000000000000000000000101, b=00000000000000000000000000000101, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1080, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1100, a=00000000000000000000000000001100, b=00000000000000000000000000000011, alu_op=110, r=00000000000000000000000000001001, cout=1, z=0, v=0
# time = 1120, a=00000000000000000000000000000110, b=00000000000000000000000000001001, alu_op=110, r=11111111111111111111111111111101, cout=0, z=0, v=0
# time = 1140, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=110, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1160, a=00000000000000000000000000000010, b=00000000000000000000000000001010, alu_op=110, r=11111111111111111111111111111000, cout=0, z=0, v=0
# time = 1180, a=00000000000000000000000000001101, b=00000000000000000000000000000011, alu_op=110, r=00000000000000000000000000001010, cout=1, z=0, v=0
# time = 1200, a=00000000000000000000000000000110, b=00000000000000000000000000001101, alu_op=110, r=11111111111111111111111111111001, cout=0, z=0, v=0
# time = 1220, a=00000000000000000000000000001010, b=00000000000000000000000000001110, alu_op=110, r=11111111111111111111111111111100, cout=0, z=0, v=0
# time = 1240, a=00100000010000000000000000000011, b=01000010000000001000000000000011, alu_op=110, r=11011110001111111000000000000000, cout=0, z=0, v=0
# time = 1260, a=00000000000000000000000000000000, b=00000000000000000000000000001111, alu_op=110, r=11111111111111111111111111110001, cout=0, z=0, v=0
# time = 1280, a=00000000000000000000000000000000, b=00000000000000000000000000000000, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1300, a=00000000000000000000000000000001, b=00000000000000000000000000000001, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1320, a=00000000000000000000000000000010, b=00000000000000000000000000000010, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1340, a=00000000000000000000000000000100, b=00000000000000000000000000000100, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1360, a=00000000000000000000000000001000, b=00000000000000000000000000001000, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1380, a=00000000000000000000000000000101, b=00000000000000000000000000000101, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1400, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1420, a=00000000000000000000000000001100, b=00000000000000000000000000000011, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1440, a=00000000000000000000000000000110, b=00000000000000000000000000001001, alu_op=111, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 1460, a=00000000000000000000000000001010, b=00000000000000000000000000001010, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1480, a=00000000000000000000000000000010, b=00000000000000000000000000001010, alu_op=111, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 1500, a=00000000000000000000000000001101, b=00000000000000000000000000000011, alu_op=111, r=00000000000000000000000000000000, cout=1, z=1, v=0
# time = 1520, a=00000000000000000000000000000110, b=00000000000000000000000000001101, alu_op=111, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 1540, a=00000000000000000000000000001010, b=00000000000000000000000000001110, alu_op=111, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 1560, a=00100000010000000000000000000011, b=01000010000000001000000000000011, alu_op=111, r=00000000000000000000000000000001, cout=0, z=0, v=0
# time = 1580, a=00000000000000000000000000000000, b=00000000000000000000000000001111, alu_op=111, r=00000000000000000000000000000001, cout=0, z=0, v=0
```

Ödevde ekstra olarak yapılanlar:

1. 1-Bit ALU MSB tasarlanmıştır.
2. 4x1Mux 2x1Mux kullanılarak tasarlanmıştır.
3. Xor kapısı tasarlanmıştır.
4. MSB alu kullanılarak 32-bit alu tasarlanmıştır. Bu yapı sayesinde signed ve unsigned sayılarla işlem yapılması sağlanmıştır.