

Multiplexors

Lecture 23 Section B.3

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1 Multiplexors

- A 2:1 1-bit Multiplexor
- A 4:1 1-bit Multiplexor
- A 2:1 2-bit Multiplexor

2 Building Bigger MUXs

- A 4:1 2-bit Multiplexor

1 Multiplexors

- A 2:1 1-bit Multiplexor
- A 4:1 1-bit Multiplexor
- A 2:1 2-bit Multiplexor

2 Building Bigger MUXs

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Multiplexors

Definition (Multiplexor)

A **multiplexor** is an electronic circuit that uses an input control signal (**select**) to select one input data signal from among several input data signals.

1 Multiplexors

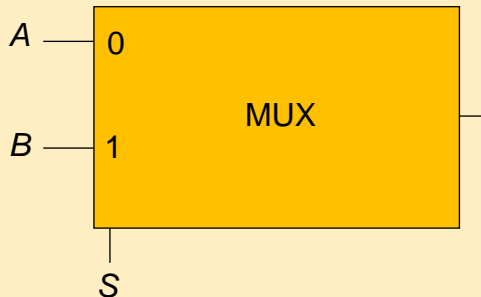
- A 2:1 1-bit Multiplexor
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- A 2:1 2-bit Multiplexor

2 Building Bigger MUXs

- A 4:1 2-bit Multiplexor

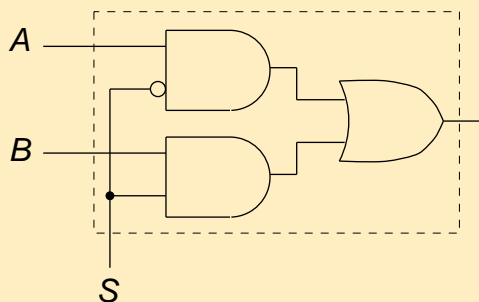
Multiplexors

Multiplexor



- The above multiplexor selects input *A* if the control *S* is 0 and it selects input *B* if the control *S* is 1.

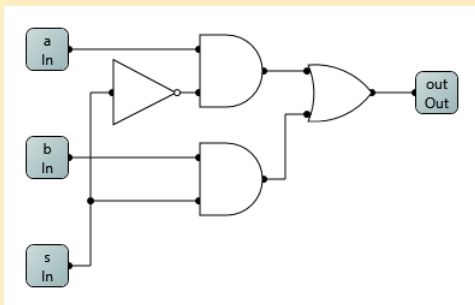
Multiplexor



- The above multiplexer selects input A if the control S is 0 and it selects input B if the control S is 1.

Multiplexors

Multiplexor



- The above multiplexor selects input A if the control S is 0 and it selects input B if the control S is 1.

2-Way Multiplexor

```
switch (S)
{
    case 0: cout << A; break;
    case 1: cout << B; break;
}
```

Varieties of Multiplexors

- There is a great variety of choices when designing a multiplexor.
 - The number of inputs m (a power of 2).
 - The bit-width of each input n (a power of 2).
 - There is always only 1 output and its width is the same as the widths of the inputs.
- We will label such a multiplexor a " $m:1$ n -bit" multiplexor.
- For example, if there are 4 inputs, each with a width of 2 bits, then we have a 4:1 2-bit multiplexor, which we will denote MUX 4:1 (2).

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- A 2:1 1-bit Multiplexor
- **A 4:1 1-bit Multiplexor**
- A 2:1 2-bit Multiplexor

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- A 4:1 2-bit Multiplexor

Example (4-Way Multiplexor)

Design a 4-way multiplexor that will use two control signals S_0 and S_1 to select from among four input data signals A , B , C , and D .

- 00 will select A .
- 01 will select B .
- 10 will select C .
- 11 will select D .

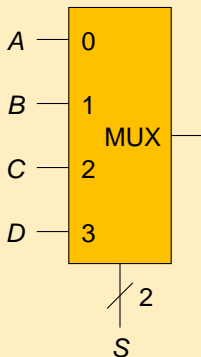
Example (4-Way Multiplexor)

Design a 4-way multiplexor that will use two control signals S_0 and S_1 to select from among four input data signals A , B , C , and D .

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-
- How do we do it?

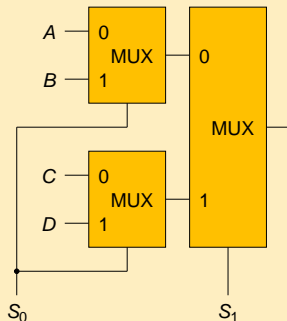
Multiplexors

Multiplexor



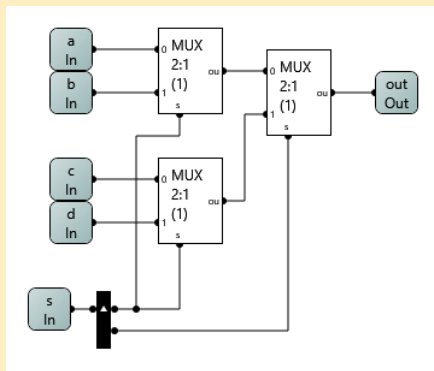
Multiplexors

Multiplexor



Multiplexors

Multiplexor



4-Way Multiplexor

```
switch (S)
{
    case 0: cout << A; break;
    case 1: cout << B; break;
    case 2: cout << C; break;
    case 3: cout << D; break;
}
```

1 Multiplexors

- A 2:1 1-bit Multiplexor
- A 4:1 1-bit Multiplexor
- A 2:1 2-bit Multiplexor

2 Building Bigger MUXs

- A 4:1 2-bit Multiplexor

Example (2-Way 2-bit Multiplexor)

Design a 2-way 2-bit multiplexor that will use one control signals S to select from between two 2-bit input signals A and B .

- 0 will select A .
- 1 will select B .

Example (2-Way 2-bit Multiplexor)

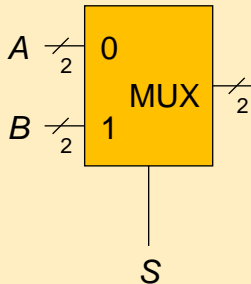
Design a 2-way 2-bit multiplexor that will use one control signals S to select from between two 2-bit input signals A and B .

- 0 will select A .
- 1 will select B .

- How do we do it?

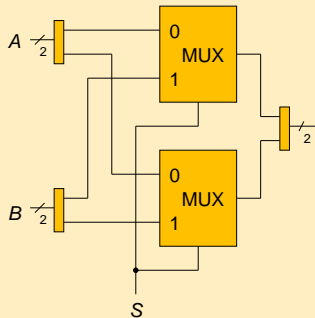
A 2:1 2-bit Multiplexor

2:1 2-bit Multiplexor



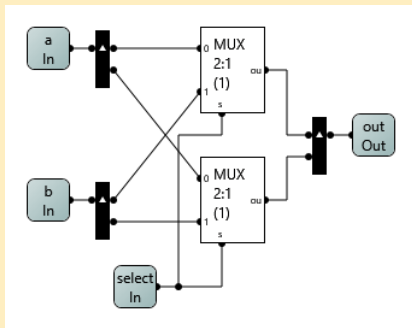
A 2:1 2-bit Multiplexor

2:1 2-bit Multiplexor



A 2:1 2-bit Multiplexor

2:1 2-bit Multiplexor



1 Multiplexors

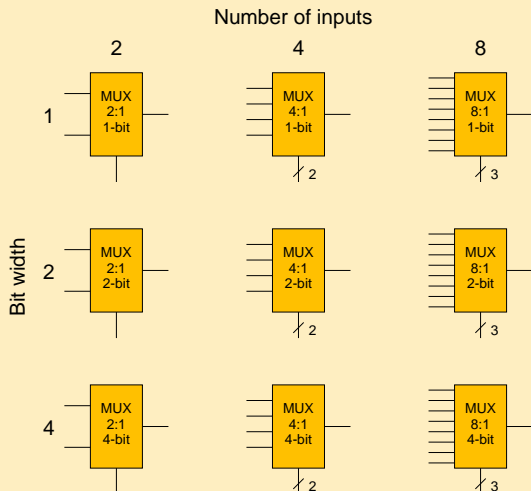
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2 Building Bigger MUXs

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Building Bigger MUXs

Building Bigger MUXs



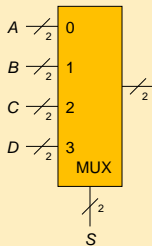
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2 Building Bigger MUXs

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A 4:1 2-bit Multiplexor



- How do we build an 4:1 2-bit multiplexor?

A 4:1 2-bit Multiplexor

- We have two choices

A 4:1 2-bit Multiplexor

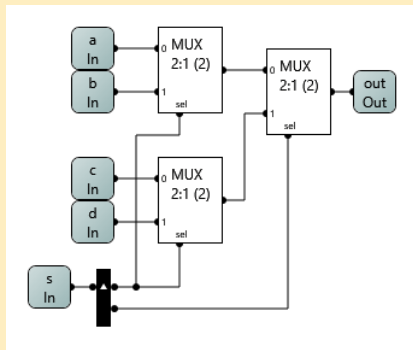
- We have two choices
- 1st choice: Build it recursively from two 2:1 2-bit MUXs.

A 4:1 2-bit Multiplexor

- We have two choices
- 1st choice: Build it recursively from two 2:1 2-bit MUXs.
- 2nd choice: Build it recursively from two 4:1 1-bit MUXs.

4:1 2-bit Multiplexors

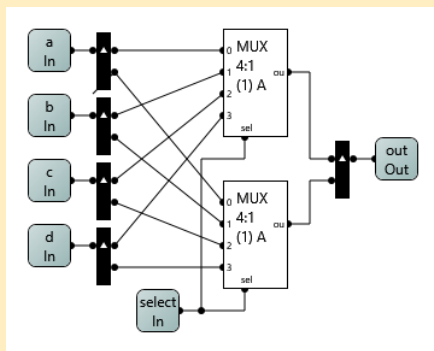
4:1 2-bit Multiplexors



Built from two 2:1 2-bit MUXs

4:1 2-bit Multiplexors

4:1 2-bit Multiplexors



Built from two 4:1 1-bit MUXs