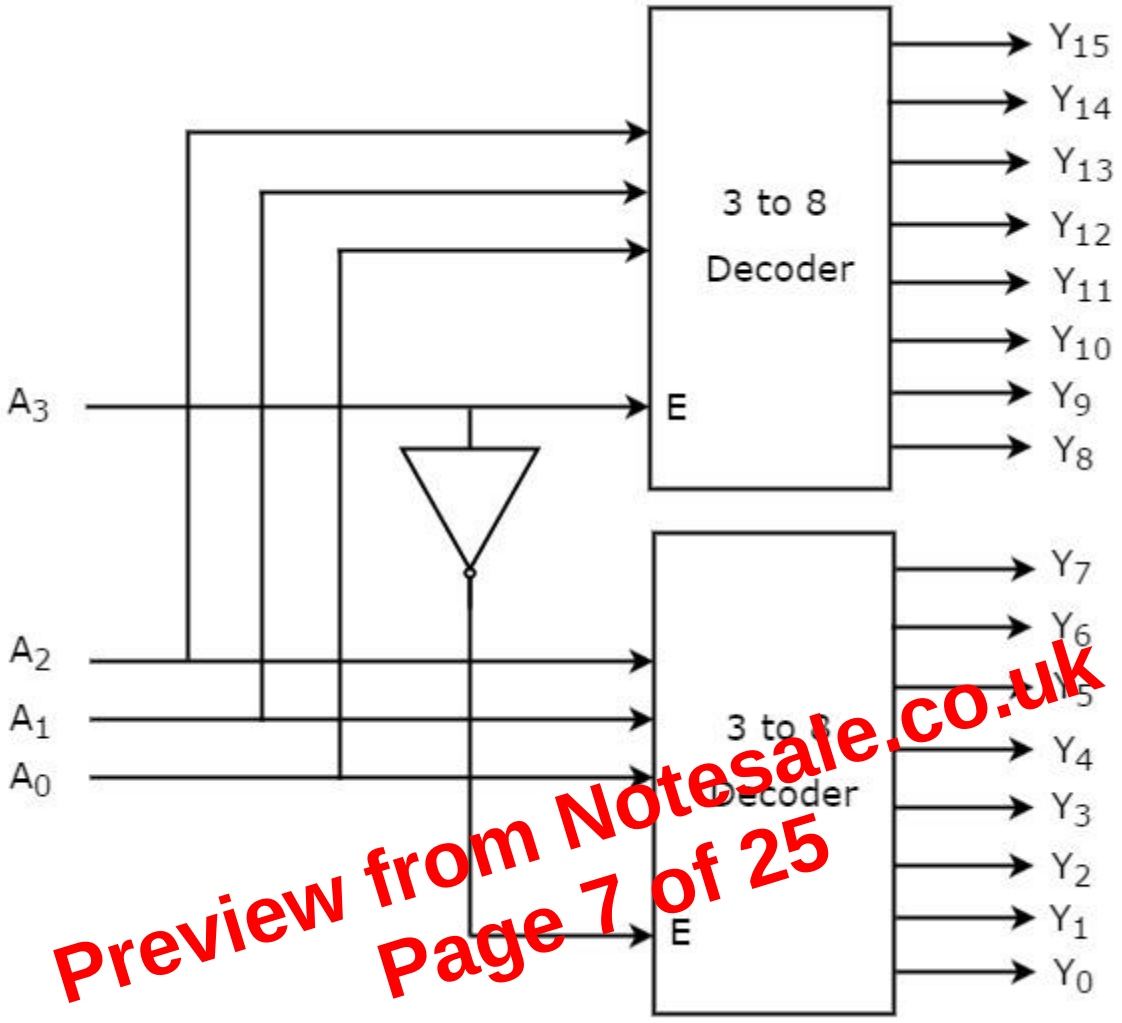
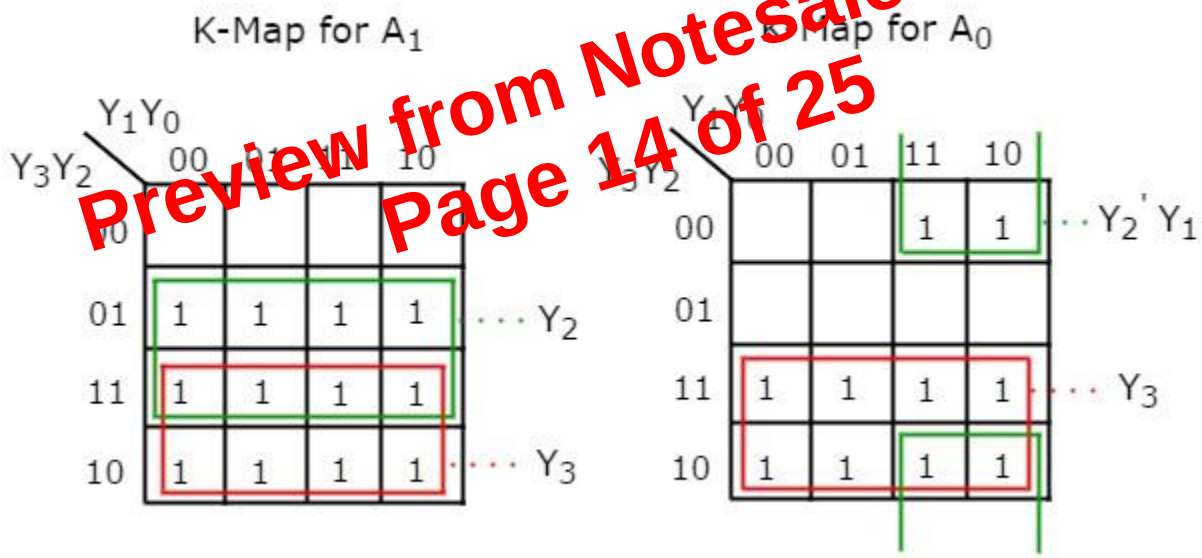


The parallel inputs A_2, A_1 & A_0 are applied to each 3 to 8 decoder. The complement of input, A3 is connected to Enable, E of lower 3 to 8 decoder in order to get the outputs, Y_7 to Y_0. These are the lower eight min terms. The input, A_3 is directly connected to Enable, E of upper 3 to 8 decoder in order to get the outputs, Y_{15} to Y_8. These are the higher eight min terms.

0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	x	0	1	1
0	1	x	x	1	0	1
1	x	x	x	1	1	1

Use 4 variable K-maps for getting simplified expressions for each output.



The simplified Boolean functions are

$$A1=Y3+Y2A1=Y3+Y2$$

A0=Y3+Y2’Y1A0=Y3+Y2’Y1

Similarly, we will get the Boolean function of output, V as

The outputs of first stage 4x1 Multiplexers are applied as inputs of 2x1 Multiplexer that is present in second stage. The other selection line, s_2 is applied to 2x1 Multiplexer.

- If s_2 is zero, then the output of 2x1 Multiplexer will be one of the 4 inputs I_3 to I_0 based on the values of selection lines s_1 & s_0.
- If s_2 is one, then the output of 2x1 Multiplexer will be one of the 4 inputs I_7 to I_4 based on the values of selection lines s_1 & s_0.

Therefore, the overall combination of two 4x1 Multiplexers and one 2x1 Multiplexer performs as one 8x1 Multiplexer.

16x1 Multiplexer

In this section, let us implement 16x1 Multiplexer using 8x1 Multiplexers and 2x1 Multiplexer. We know that 8x1 Multiplexer has 8 data inputs, 3 selection lines and one output. Whereas, 16x1 Multiplexer has 16 data inputs, 4 selection lines and one output.

So, we require two 8x1 Multiplexers in first stage in order to get the 16 data inputs. Since, each 8x1 Multiplexer produces one output, we require a 2x1 Multiplexer in second stage by considering the outputs of first stage as inputs and to produce the final output.

Let the 16x1 Multiplexer has sixteen data inputs I_{15} to I_0, four selection lines s_3 to s_0 and one output Y. The Truth table of 16x1 Multiplexer is shown below.

Selection Inputs	Output

S_3	S_2	S_1	S_0	Y
0	0	0	0	I_0
0	0	0	1	I_1
0	0	1	0	I_2
0	0	1	1	I_3
0	1	0	0	I_4
0	1	0	1	I_5
0	1	1	0	I_6
0	1	1	1	I_7
1	0	0	0	I_8
1	0	0	1	I_9
1	0	1	0	I_{10}
1	0	1	1	I_{11}
1	1	0	0	I_{12}