KASUS 1.2 TEKNIK DIGITAL DAN RANGKAIAN KOMBINASIONAL

Deskripsi :

Pada Kasus Teknik Digital dan Rangkaian Kombinasional kali ini diberikan sub kasus yang meliputi :

5. Rangkaian kombinasional

5.1 Perancangan rangkaian digital

5.2 Macam-macam rangkaian kombinasional

- 5.2.1 Unit-unit penjumlah (Adder)
- 5.2.2 Unit pengurang (Substractor)
- 5.2.3 Multiplier
- 5.2.4 Divider
- 5.2.5 Decoder
- 5.2.6 Encoder
- 5.2.7 Binary Code
- 5.2.8 Code Converter
- 5.2.9 Multiplexer
- 5.2.11 Demultiplexer
- 5.2.12 Shifter

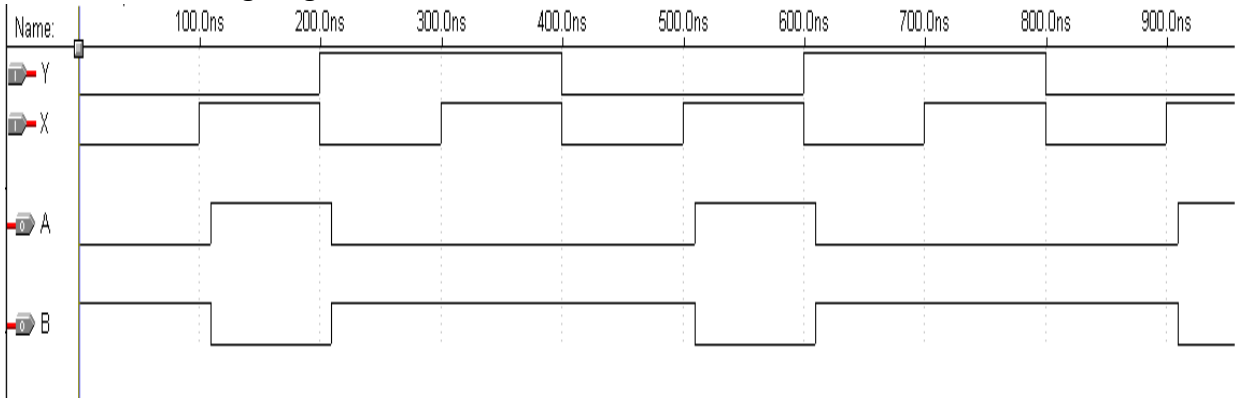
Tujuan

1. Mahasiswa dapat mengimplementasikan minimasi Fungsi Boolean pada kasus-kasus tertentu sesuai dengan fungsi dan perangkat/komponen yang digunakan
2. Mahasiswa dapat membaca dan merancang rangkaian kombinasional sesuai *requirenment* yang ditentukan

Penilaian

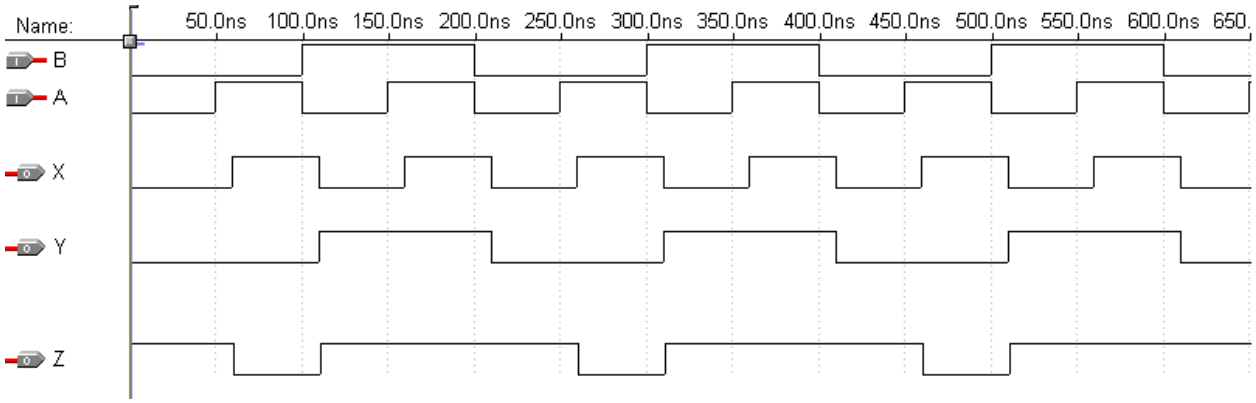
1. Rencana kerja tim
2. Komunikasi dan Diskusi yang dibangun
3. Ketepatan waktu pengerjaan
4. Kebenaran hasil pengerjaan kasus

1. Consider the timing diagram below



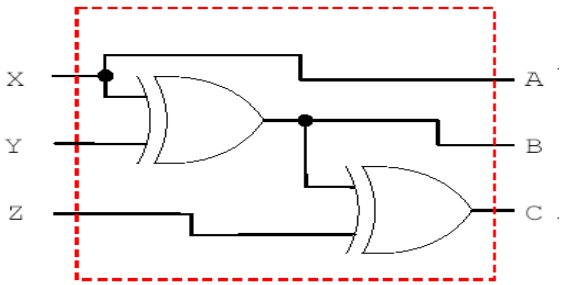
In the picture above, X and Y are the input variables while A and B is the output variable. Make a truth table of the timing diagram above then write the Boolean function of its

2. Consider the timing diagram below



In the picture above, A and B are the input variables while X, Y and Z is the output variable. Make a truth table of the timing diagram above then write the Boolean function of its

3. Consider the following logic circuit



Make a truth table for logic circuit above, then give a simplified Boolean equation for each output and analysis of logic circuits what it is!

4. To maintain the security of the environment, the storage space of Ammonia (NH3) in a laboratory equipped with alarm systems. Normal conditions in the storage room is maintained at a temperature (T) 12^{o} C, pressure (P) 5 atmospheres and humidity (D) 10%. The alarm system will work (reads) if the temperature <12^{o} C, pressures <5 atmospheres and humidity >10%, or temperature <12^{o} C, pressures >5 atmospheres and humidity <10%, or temperature >12^{o} C, pressure <5 atmosphere and humidity >10%, or temperature > 12^{o} C, pressures >5 atmospheres and humidity < 10%. Alarm system is used by the computer as the input signal to restore the room to return to normal conditions.
   a. Implement the above requirements into a truth table to determine in advance the number of input and output variables are required.
   b. Simplify the Boolean function resulting from the translation of ideas according requirenment at a point above
   c. Implemented in a logic circuit with only basic gates

5. Design a circuit that will tell whether a given month has 31 days in it. The month is specified by a 4-bit inputs, $A_{3:0}$. For example, if the inputs are 0001, the month is January, and if the inputs are 1100, the month is December. The circuit output, *Y*, should be HIGH only when the month specified by the inputs has 31 days in it. Write the simplied equations, and draw the circuit diagram using a minimum number of gates. (Hint: Remember to take advantage of don't cares)

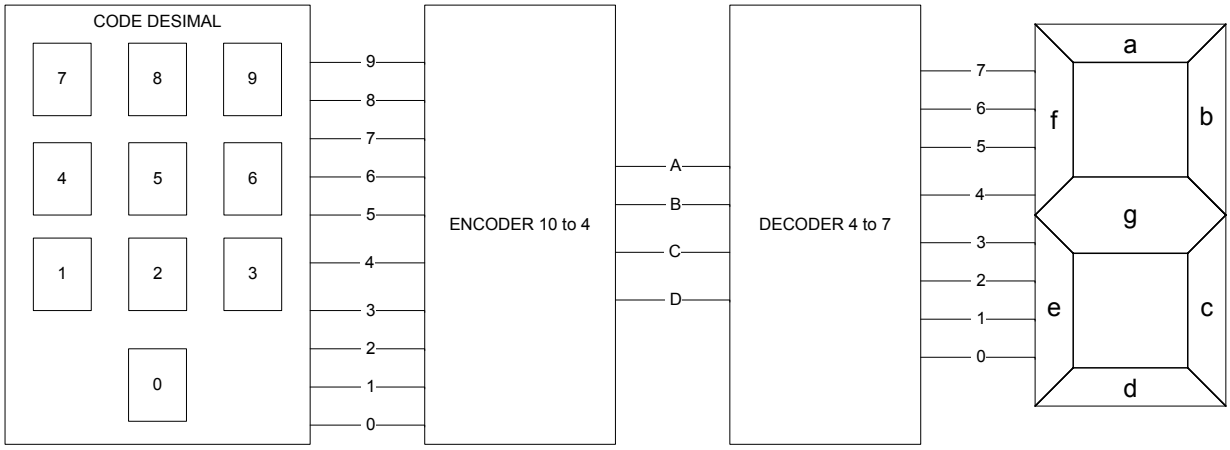
6. A *priority encoder* has 2^{N} inputs. It produces *N*-bit binary output indicating the most significant bit of the input thats is TRUE, or 0 if none of the inputs are TRUE. It also produces an output *NONE* that is TRUE if none of the inputs bits are TRUE. Design an eight-input priority encoder with inputs $A_{7:0}$ and outputs $Y_{2:0}$ and NONE. Give a simplified Boolean equation for each output, and sketch a schematic

7. An M-bit *thermometer code* for the number *k* consists of *k* 1's in the least significant bit positions and M – *k 0's* in all the more significant bit positions. A *binary-thermometer code converter* has *N* inputs and 2^{N}-1 outputs. It produces a 2^{N}-1 bit thermometer code for the number specified by the input. For example, if the inputs is 110, the output should be 0111111 . Design a 3:7 *binary-thermometer code converter*. Give a simlified Boolean equation for each output, and sketch a shematic.

8. Implement the function below using
   a. an 8:1 multiplexer
   b. a 4:1 multiplexer and one inverter
   c. a 2:1 multiplexer and two other logic gates

   the function are :
   i. $\mathrm{Y} = \mathrm{BC} + \overline{\mathrm{A}}\overline{\mathrm{B}}\overline{\mathrm{C}} + \mathrm{B}\overline{\mathrm{C}}$
   ii. $Y = \overline{A + \bar{A}B + \bar{A}\bar{B}} + \overline{A + \bar{B}}$
   iii. $Y = ABC + ABD + ABE + ACD + ACE + (\overline{A + D + E}) + \bar{B}\bar{C}D + \bar{B}\bar{C}E + \bar{B}\bar{D}\bar{E} + \bar{C}\bar{D}\bar{E}$

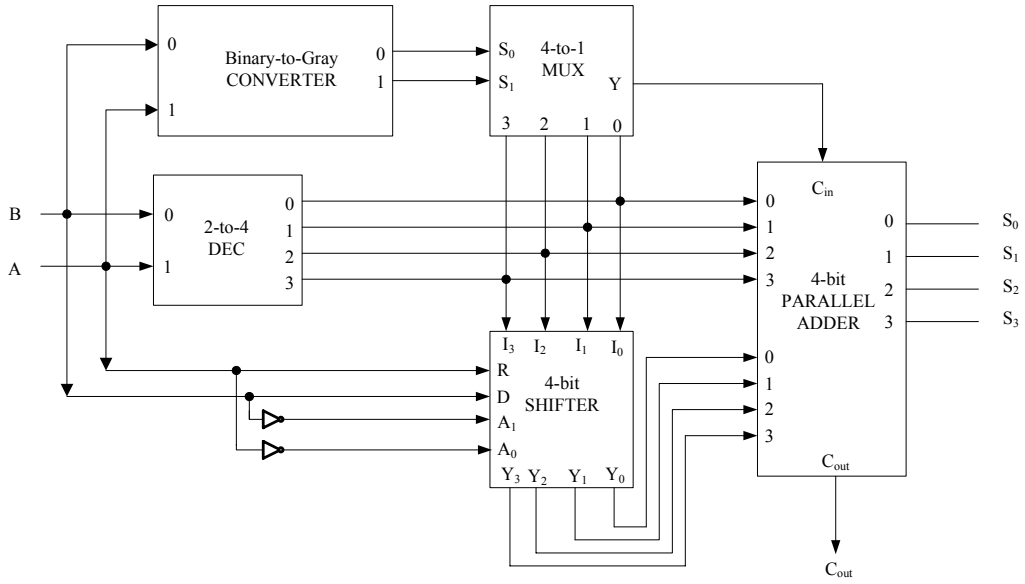
9. Consider the block diagram below



Design a circuit that can display the number on the keyboard into the 7-segment display. For example, when the number 0 on the keyboard is pressed, the display 7-segment displays the number 0. When number 1 on the keyboard is pressed, the display 7-segment will show the number 1 and so on.

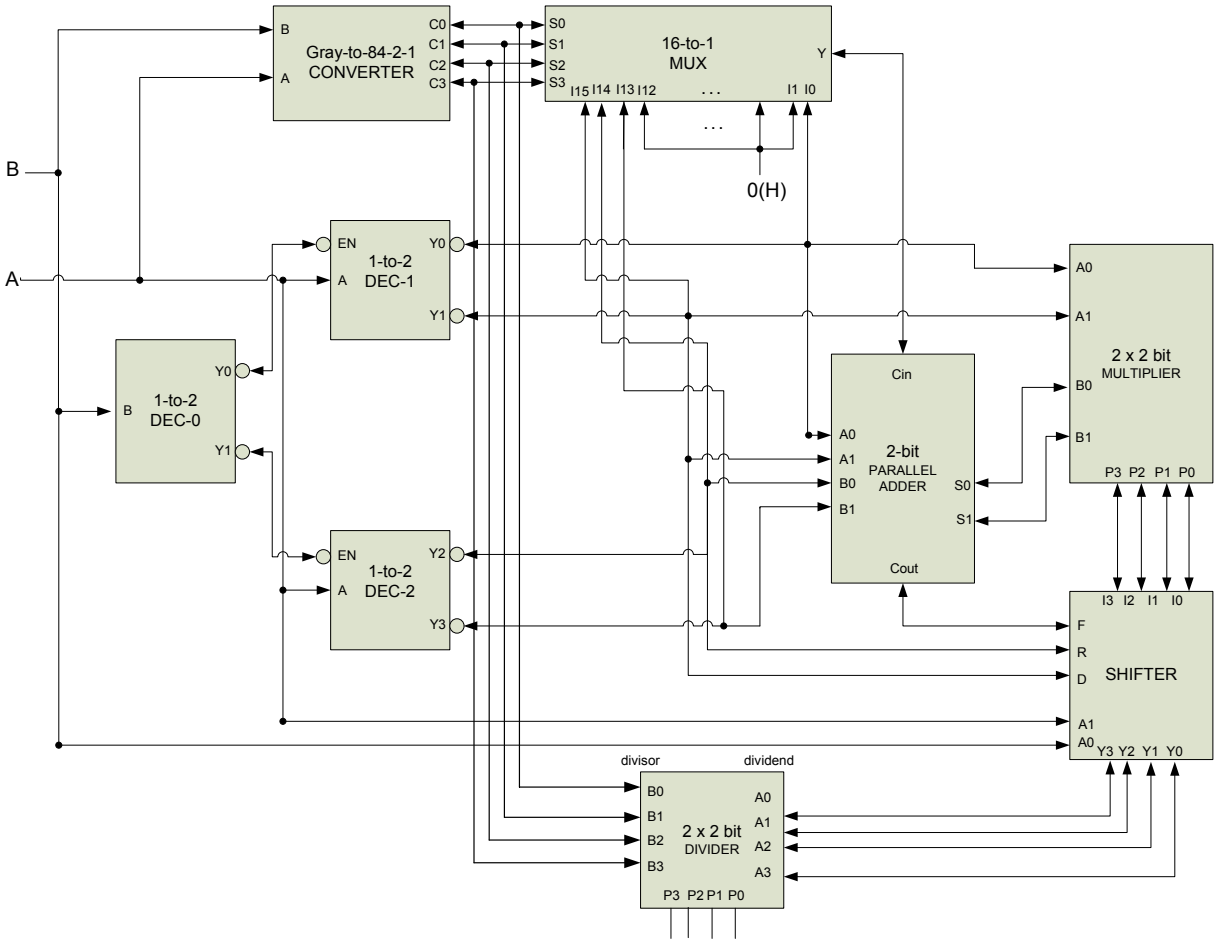
10. In the block diagram below is shown a network containing several combinational logic devices. Complete the following truth tables. Assumes that F input on shifter mode equal to zero

A	B	C_{out}	S_3	S_2	S_1	S_0
0	0					
0	1					
1	0					
1	1					



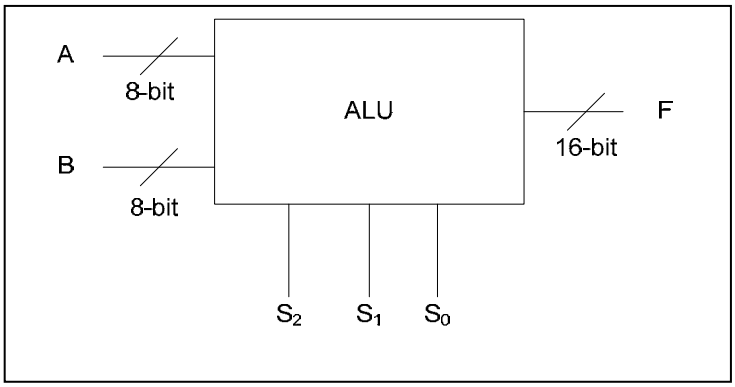
11. In the block diagram below is shown a network containing several combinational logic devices. Complete the following truth tables.

A	B	P_3	P_2	P_1	P_0
0	0				
0	1				
1	0				
1	1				



12. To make part of the ALU of a processor that can implement the required circuit Arithmetic and Logic functions in accordance with the choice of the functions assigned to the circuit as shown in the table below

Choice Functions			Functions
S_2	S_1	S_0	
0	0	0	A + B (2's complement)
0	0	1	A – B (2's complement)
0	1	0	A x B (Multiplier)
0	1	1	A and B
1	0	0	A or B
1	0	1	A
1	1	0	A'
1	1	1	B'



Sketch a logic circuit / block diagram to represent the ALU function above!. Assume that the C_{out}/B_{out} of the sum function is considered as an overflow bit