Project 1 COMBINATIONAL CIRCUITS

PROJECT LIST

1. Design a combinational circuit which realizes **y = sin(x)** function.
   - **x input** is a 9-bit positive integer and will take the value for a degree in the interval [0,360).
   - **y output** is a signed 6-bit fixed-point number with 2-digits decimal and 4-digits fraction and will take the value for sin(x) in the interval [-1,1].
2. Design a combinational circuit which realizes **y = cos(x)** function.
   - **x input** is a 9-bit positive integer and will take the value for a degree in the interval [0,360).
   - **y output** is a signed 6-bit fixed-point number with 2-digits decimal and 4-digits fraction and will take the value for sin(x) in the interval [-1,1].
3. Design a combinational circuit which realizes **y = tan(x)** function.
   - **x input** is a 9-bit positive integer and will take the value for a degree in the interval [0,360).
   - **y output** is a signed 6-bit fixed-point number with 2-digits decimal and 4-digits fraction and will take the value for sin(x) in the interval [-1,1].
4. Design a combinational circuit which realizes **y = arcsin(x)** function.
   - **x input** is a signed 6-bit fixed-point number with 2-digits decimal and 4-digits fraction and will take the value for sin(x) in the interval [-1,1].
   - **y output** is a 9-bit positive integer and will take the value for a degree in the interval [0,360).
5. Design a combinational circuit which realizes **y = arccos(x)** function.
   - **x input** is a signed 6-bit fixed-point number with 2-digits decimal and 4-digits fraction and will take the value for sin(x) in the interval [-1,1].
   - **y output** is a 9-bit positive integer and will take the value for a degree in the interval [0,360).
6. Design a combinational circuit which realizes **y = arctan(x)** function.
   - **x input** is a signed 6-bit fixed-point number with 2-digits decimal and 4-digits fraction and will take the value for sin(x) in the interval [-1,1].
   - **y output** is a 9-bit positive integer and will take the value for a degree in the interval [0,360).
7. Design a combinational circuit which realizes **y = sinh(x)** function.
   - **x input** is a signed 8-bit fixed-point number with 4-digits decimal and 4-digits fraction and will take the value in the interval [-4,4).
   - **y output** is a signed 11-bit fixed-point number with 6-digits decimal and 5-digits fraction and will take the value in the interval [0,32).
8. Design a combinational circuit which realizes **y = cosh(x)** function.
   - **x input** is a signed 8-bit fixed-point number with 4-digits decimal and 4-digits fraction and will take the value in the interval [-4,4).
   - **y output** is a signed 11-bit fixed-point number with 6-digits decimal and 5-digits fraction and will take the value in the interval [0,32).
9. Design a combinational circuit which realizes **y = tanh(x)** function.
   - **x input** is a signed 8-bit fixed-point number with 2-digits decimal and 6-digits fraction and will take the value in the interval [-1,1).
   - **y output** is a signed 8-bit fixed-point number with 2-digits decimal and 6-digits fraction and will take the value in the interval [-1,1).
10. Design a combinational circuit which realizes **y = arcsinh(x)** function.
    - **x input** is a signed 11-bit fixed-point number with 6-digits decimal and 5-digits fraction and will take the value in the interval [0,32).
    - **y output** is a signed 8-bit fixed-point number with 4-digits decimal and 4-digits fraction and will take the value in the interval [-4,4).
11. Design a combinational circuit which realizes **y = arccosh(x)** function.
    - **x input** is a signed 11-bit fixed-point number with 6-digits decimal and 5-digits fraction and will take the value in the interval [0,32).
    - **y output** is a signed 8-bit fixed-point number with 4-digits decimal and 4-digits fraction and will take the value in the interval [-4,4).

12. Design a combinational circuit which realizes **y = arctanh(x)** function.
    - **x input** is a signed 8-bit fixed-point number with 2-digits decimal and 6-digits fraction and will take the value in the interval [-1,1).
    - **y output** is a signed 8-bit fixed-point number with 2-digits decimal and 6-digits fraction and will take the value in the interval [-1,1).
13. Design a combinational circuit which realizes $\mathbf{y = e^x}$ function.
    - **x input** is a signed 7-bit fixed-point number with 4-digits decimal and 3-digits fraction and will take the value in the interval [-4,4].
    - **y output** is a positive 11-bit fixed-point number with 5-digits decimal and 6-digits fraction and will take the value in the interval (0,55).
14. Design a combinational circuit which realizes $\mathbf{y = 3^x}$ function.
    - **x input** is a signed 7-bit fixed-point number with 4-digits decimal and 3-digits fraction and will take the value in the interval [-4,4].
    - **y output** is a positive 13-bit fixed-point number with 7-digits decimal and 6-digits fraction and will take the value in the interval (0,81].
15. Design a combinational circuit which realizes $\mathbf{y = 2.5^x}$ function.
    - **x input** is a signed 7-bit fixed-point number with 4-digits decimal and 3-digits fraction and will take the value in the interval [-4,4].
    - **y output** is a positive 13-bit fixed-point number with 6-digits decimal and 7-digits fraction and will take the value in the interval (0,40).
16. Design a combinational circuit which realizes **y = ln(x)** function.
    - **x input** is a positive 11-bit fixed-point number with 5-digits decimal and 6-digits fraction and will take the value in the interval (0,55).
    - **y output** is a signed 7-bit fixed-point number with 4-digits decimal and 3-digits fraction and will take the value in the interval [-4,4].
17. Design a combinational circuit which realizes $\mathbf{y = \log_{10}(x)}$ function.
    - **x input** is a positive 13-bit fixed-point number with 10-digits decimal and 3-digits fraction and will take the value in the interval (0,1000].
    - **y output** is a signed 6-bit fixed-point number with 3-digits decimal and 3-digits fraction and will take the value in the interval [-3,3].
18. Design a combinational circuit which realizes $\mathbf{y = x^3}$ function.
    - **x input** is a signed 6-bit fixed-point number with 3-digits decimal and 3-digits fraction and will take the value in the interval [-3,3].
    - **y output** is a positive 9-bit fixed-point number with 6-digits decimal and 3-digits fraction and will take the value in the interval [-27,27].
19. Design a combinational circuit which realizes $\mathbf{y = x^5}$ function.
    - **x input** is a signed 6-bit fixed-point number with 3-digits decimal and 3-digits fraction and will take the value in the interval (-2,2).
    - **y output** is a positive 9-bit fixed-point number with 6-digits decimal and 3-digits fraction and will take the value in the interval (-32,32).
20. Design a combinational circuit which realizes $\mathbf{y = x^2}$ **mod 667** function.
    - **x input** is a positive 9-bit integer and will take the value in the interval [0,511].
    - **y output** is a positive 9-bit integer and will take the value in the interval [0,511].
21. Design a combinational circuit which realizes $\mathbf{y = x^3}$ **mod 667** function.
    - **x input** is a positive 9-bit integer and will take the value in the interval [0,511].
    - **y output** is a positive 9-bit integer and will take the value in the interval [0,511].
22. Design a combinational circuit which realizes $\mathbf{y = 3^x}$ **mod 667** function.
    - **x input** is a positive 9-bit integer and will take the value in the interval [0,511].
    - **y output** is a positive 9-bit integer and will take the value in the interval [0,511].
23. Design a combinational circuit which realizes $\mathbf{y = 5^x}$ **mod 667** function.
    - **x input** is a positive 9-bit integer and will take the value in the interval [0,511].

- **y output** is a positive 9-bit integer and will take the value in the interval [0,511].

24. Design a combinational circuit which realizes **y =** $\sqrt{x}$ function.
    - **x input** is a positive 9-bit fixed-point number with 6-digits and 3-digits fraction and will take the value in the interval [0,16].
    - **y output** is a positive 6-bit fixed-point number with 3-digits decimal and 3-digits fraction and will take the value in the interval [0,4].
25. Design a combinational circuit which realizes **y =** $\sqrt{3x}$ function.
    - **x input** is a positive 9-bit fixed-point number with 6-digits and 3-digits fraction and will take the value in the interval [0,16].
    - **y output** is a positive 6-bit fixed-point number with 3-digits decimal and 3-digits fraction and will take the value in the interval [0,7).

DIRECTIVES FOR ALL PROJECTS

1. You will produce the truth table of your design by using MATLAB, C etc.
2. You will write the Verilog code for your design by using the truth table as reference.
3. Input values for testbenches are going to be read from a text file, and output values are going to be written into another text file. You can prepare your input text by using MATLAB, C etc.
4. Project report is going to be 4 pages at most.
5. You must explain how your circuit works in your project report.

Ögrenci No	Ad Soyad	Question
40160054	Yavuz Sultan Çakırca	1
40160243	Büşra Yassıbaş	2
40160256	Salih Daysal	3
40160262	Furkan Akçil	4
40170011	Abdullah Sak	5
40170038	Enes Mutta	6
40170040	Elif Dinç	7
40170051	Gülce Baysal	8
40170077	Mustafa Ensar Işkın	9
40170089	Furkan Emre Işık	10
40170099	Can Bozacı	11
40170213	Behiç Erdem	12
40170217	Seçkin Gezer	13
40170255	Melih Furkan Şen	14
40170742	Cihad Sefa Dağdeviren	15
40170931	Erdem Ibraimi	16
40180021	Muhammet Yusuf Alkuş	17
40180122	Muhammed Furkan Ertural	18
40180710	Enes Dilbilmez	19
40180730	Asya Turhal	20
40200789	Canberk Köse	21