Midterm Exam

This exam is closed book and closed notes. Calculators are not permitted. Answers must be marked on the Scantron form to be graded.

Keep your student or government issued ID on your desk. Brimmed hats must be removed or turned around backwards. Only unmarked water bottles are permitted. Backpacks must be placed at the front of the room. Your cell phone must be on a setting where it will not make noise or vibrate.

All questions are multiple choice. Assume the first answer is 'A', the second is 'B' and so on. Some questions have more than one correct answer. You must mark all correct answers to receive credit for a question. Some questions refer to figures that are displayed on the supplemental sheet.

You have 90 minutes to complete this exam.

Note: an underscore followed by a number indicates the base system. Unless otherwise noted, a number followed by no underscore is in decimal.

1. T/F: $\sim(AB) = (\sim A) \cdot (\sim B)$ 0 points

- ◯ True
- ◯ False
- ◯ It depends

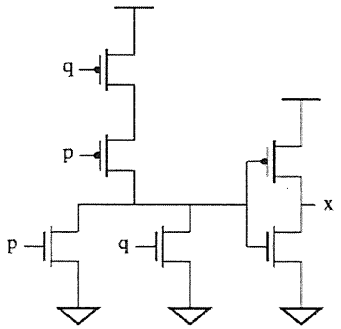
2. T/F: $\sim(A + B) = (\sim A) + (\sim B)$ 0 points

- ◯ True
- ◯ False
- ◯ It depends

3. Assume we have a base 32 numbering system where A = 10, B = 11, C = 12, D = 13, etc. Convert the number EGAD_32 to binary. 0 points

- ◯ 1110 1111 1010 1101
- ◯ 11110 10000 11010 11101
- ◯ 001110 010000 001010 001101
- ◯ 01110 10000 01010 01101
- ◯ 01101 01010 10000 01110

4 Which circuits from Figure 2 are logically equivalent to this circuit? Select all that apply. 0 points



- [ ] circuit 2
- [ ] circuit 3
- [ ] circuit 4
- [ ] circuit 6
- [ ] circuit 7

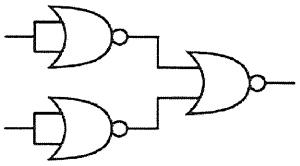
5 Assume a signed integer x = 0x7A. What are the results of x >> 8 (shift right by 8) for logical shift and arithmetic shift respectively? 0 points

- ○ 0x00 and 0xFF
- ○ 0x7A and 0x7A
- ○ 0x00 and 0x00
- ○ 0xFF and 0x00
- ○ 0xA7 and 0x7A

6 T/F: In a CMOS circuit, the pull down network is made up of PMOS transistors. 0 points

- ○ True
- ○ False

7 What element is this circuit logically equivalent to? 0 points



- ○ 2-1 mux
- ○ full adder
- ○ half adder
- ○ or gate
- ○ and gate

8 Which of these 8-bit two's complement computations has overflow but no carry out? Select all that apply. 0 points

- [ ] 0x80 + 0xFF
- [ ] 0x5C + 0x6D
- [ ] 0x42 + 0x42
- [ ] 0xF5 + 0xA0
- [ ] 0x64 + 0x64

9 Sign extend the following 5-bit two's complement number to 8-bit: 10011_2 0 points

- ◯ 00010011_2
- ◯ 0xF3
- ◯ 0x00010011
- ◯ 0x11110011
- ◯ 0x13

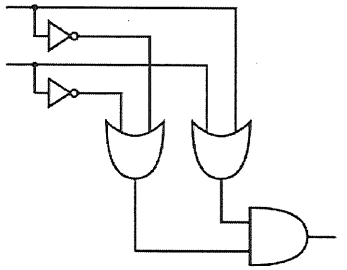
10 How many select lines are needed for a multiplexor with 33 inputs? 0 points

- ◯ 5
- ◯ 4
- ◯ 6
- ◯ 8
- ◯ 16

11 Convert 0x2013 to base 4. Assume all answers are in base 4. 0 points

- ◯ 8211
- ◯ 2000103
- ◯ 010 000 001 011
- ◯ 10 00 01 11
- ◯ 0010 0000 0001 0011

12 What logic element does this circuit represent? 0 points

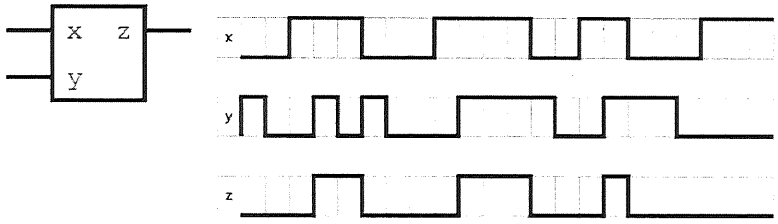


- ◯ xor gate
- ◯ decoder
- ◯ D latch
- ◯ full adder
- ◯ 2-1 mux

13 Who reported the first computer bug? 0 points

- ◯ Grace Hopper
- ◯ Konrad Zuse
- ◯ Ada Lovelace
- ◯ Alan Turing
- ◯ Charles Babbage

14 What device does this timing diagram represent? 0 points



- ◯ D-R latch
- ◯ D latch
- ◯ S-R latch, active low
- ◯ S-R latch, active high
- ◯ D flip flop

15 Assume a signed integer x = 10100010_2. What are the results of x >> 2 (shift right by 2) for logical shift and arithmetic shift respectively? Answers are presented in binary. 0 points

- ◯ 10001000 and 10001010
- ◯ 11101000 and 00101000
- ◯ 00101000 and 11101000
- ◯ 00101000 and 00101000
- ◯ 10001010 and 10001000

16 What is the largest number that can be represented with 6 bits in excess 30 notation? 0 points

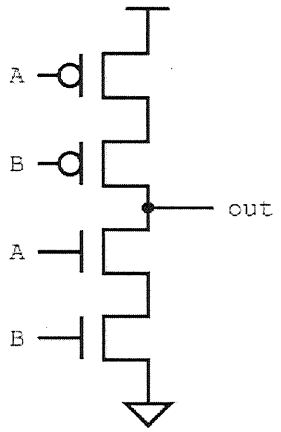
- ◯ 33
- ◯ -30
- ◯ 31
- ◯ 1
- ◯ 63

17 What is the sum of products solution to this truth table? Select all that apply. 0 points

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

- ☐ F = (A + B + C) · (A + B + ~C) · (A + ~B + ~C)
- ☐ F = (~A)·B·(~C) + A·(~B)·(~C) + A·(~B)·C + A·B·(~C) + A·B·C
- ☐ F = A·B·C + A·B·(~C) + A·(~B)·(~C)
- ☐ F = A·(~B)·C + (~A)·B·C + (~A)·B·(~C) + (~A)·(~B)·C + (~A)·(~B)·(~C)
- ☐ F = (~A)·(~B)·(~C) + (~A)·(~B)·C + (~A)·B·C

18 What is wrong with the following CMOS circuit? 0 points



- If A and B are 0, the power supply will be shorted to ground.
- If A and B are 0, the output will be unknown.
- If A and B are 1, the output will be unknown.
- If A and B are 1, the power supply will be shorted to ground.
- None of the other answers

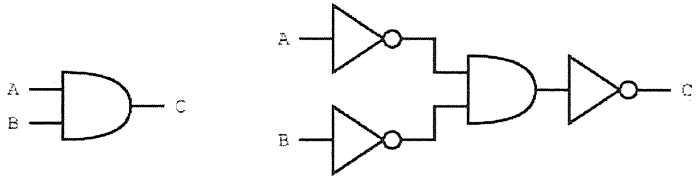
19 Convert 10111100_2 to decimal 0 points

- 752
- 94
- 188
- 1000
- 367

20 What is the correct sequence of Git commands to submit a file to the Git server? 0 points

- commit, add, push
- add, commit, push
- push, add, commit
- commit, push, add
- add, push, commit

21 T/F: The two circuit diagrams are logically equal. 0 points



- True
- False
- It depends

22 Sign extend the following 8 bit sign magnitude number to 10 bits: 0x7F 0 points

- ○ 0xF7F
- ○ 0x77F
- ○ 3777_8
- ○ 1111111111_2
- ○ 01333_4

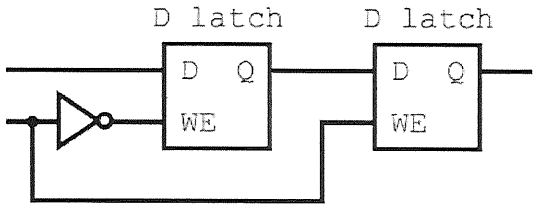
23 Given the following file structure, the command "pwd" prints /top_dir/a_dir. What is printed to the screen after the following commands are executed (to the right of the file structure)? 0 points

```
top_dir
├── a_dir
│   ├── ant.txt
│   └── apple.txt
└── b_dir
    ├── baboon.txt
    └── banana.txt
```

```
$ mkdir c_dir
$ touch cat.txt
$ cp cat.txt c_dir/
$ touch cephalopod.txt
$ mv cat.txt cephalopod.txt
$ ls
```

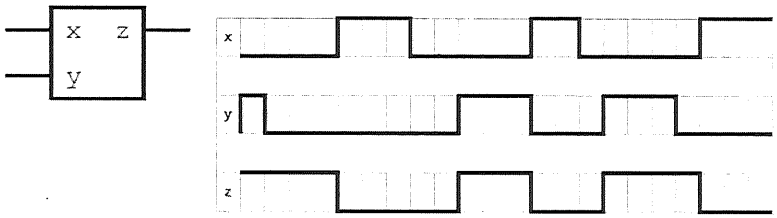
- ○ cat.txt cephalopod.txt
- ○ cat.txt
- ○ ant.txt apple.txt cat.txt c_dir/ cephalopod.txt
- ○ cephalopod.txt
- ○ ant.txt apple.txt c_dir/ cephalopod.txt

24 What does this circuit represent? 0 points



- ○ 2-bit register
- ○ full adder
- ○ cache block
- ○ D flip flop
- ○ S-R latch

25 What device does this timing diagram represent? 0 points



- ○ D flip flop
- ○ D-R latch
- ○ S-R latch, active low
- ○ D latch
- ○ S-R latch, active high

26 Assume a signed integer x = 0xA2. What are the results of x << 4 (shift left by 4) for logical shift and arithmetic shift respectively? 0 points

- ○ 20_8 and 2F_8
- ○ 0x20 and 0x2A
- ○ 040_8 and 040_8
- ○ 0x20 and 0x2F
- ○ 0x0A and 0xFA

27 Which of these 8-bit two's complement computations has carry out but no overflow? Select all that apply. 0 points

- ☐ 0x7E + 0x03
- ☐ 0xEB + 0x23
- ☐ 0xFF + 0x01
- ☐ 0x77 + 0x11
- ☐ 0x6C + 0x2D

28 What is the equivalent logic expression to ~((A + B)(~A + ~B))? 0 points

- ○ (~A)(~B) + AB
- ○ B
- ○ A
- ○ (~A)(~B)
- ○ AB

29 Convert 1101101001001_2 to base 4. Assume all answers are in base 4. 0 points

- ○ 1231021
- ○ 1B49
- ○ 3122101
- ○ DA41
- ○ 15511

30 Which elements are defined by the ISA? 0 points

- ☐ types of transistors
- ☐ memory storage format
- ☐ instruction format
- ☐ register size
- ☐ hardware implementation

31 Convert 122_4 to octal. Assume all answers are in octal. 0 points

- ○ 12
- ○ 61
- ○ 244
- ○ 8
- ○ 32

32 How many outputs does a decoder with 4 inputs have? 0 points

- ○ 1
- ○ 2
- ○ 4
- ○ 8
- ○ 16

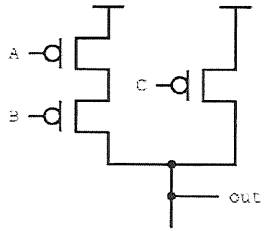
33 In a triode tube transistor, to initiate current flow, the control grid voltage must: 0 points

- ○ be equal to -10V
- ○ have a strongly positive bias with respect to the emitter
- ○ none of the other answers
- ○ have a strongly negative bias with respect to the plate
- ○ have a lower voltage than the cathode

34 Who worked with Charles Babbage on the analytical engine? 0 points

- ○ Ada Lovelace
- ○ Grace Hopper
- ○ Alan Turing
- ○ Konrad Zuse
- ○ Joseph Marie Jacquard

35 For this pull up network, what is the corresponding pull down network? See Figure 1. 0 points



- ○ A
- ○ B
- ○ C
- ○ D
- ○ E

36 Which levels of abstraction are higher than macro architecture? Select all that apply. 0 points

- [ ] micro architecture
- [ ] algorithm
- [ ] machine architecture
- [ ] instruction set architecture
- [ ] logic circuits

37 Given the following file structure and given that the command "pwd" prints /top_dir/a_dir, after you enter the command "cd ..", what will the command "ls" print? 0 points

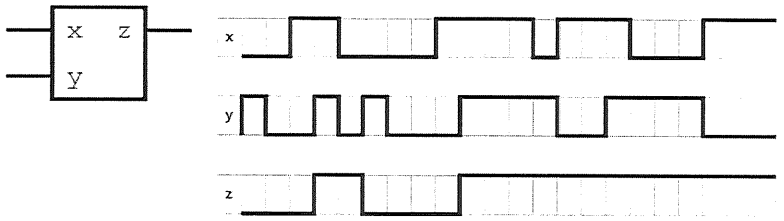
```
top_dir
├── a_dir
│   ├── ant.txt
│   └── apple.txt
└── b_dir
    ├── baboon.txt
    └── banana.txt
```

- ○ baboon.txt banana.txt
- ○ a_dir b_dir
- ○ apple.txt ant.txt baboon.txt banana.txt
- ○ top_dir a_dir b_dir apple.txt ant.txt baboon.txt banana.txt
- ○ apple.txt ant.txt

38 What is the result of the bitwise operation 10101111_2 AND 11111010_2? Answers are presented in binary. 0 points

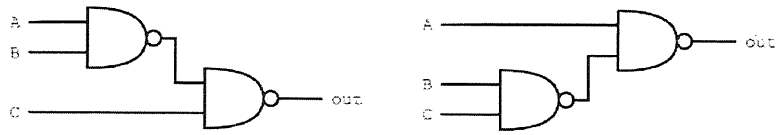
- ○ 00000000
- ○ 10101010
- ○ 11110000
- ○ 00001111
- ○ 11001100

39 What device does this timing diagram represent? 0 points



- ○ D flip flop
- ○ S-R latch, active low
- ○ D-R latch
- ○ D latch
- ○ S-R latch, active high

40 T/F: The two circuit diagrams are logically equal. 0 points



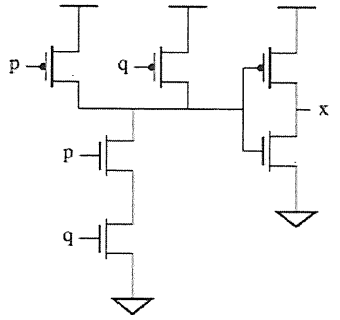
- ◯ True
- ◯ False
- ◯ It depends

41 Given the following file structure and given that the command "pwd" prints /top_dir/a_dir, what will the command "ls" print? 0 points

```
top_dir
├── a_dir
│   ├── ant.txt
│   └── apple.txt
└── b_dir
    ├── baboon.txt
    └── banana.txt
```

- ◯ top_dir a_dir b_dir apple.txt ant.txt baboon.txt banana.txt
- ◯ apple.txt ant.txt
- ◯ baboon.txt banana.txt
- ◯ a_dir b_dir
- ◯ apple.txt ant.txt baboon.txt banana.txt

42 Which circuits from Figure 2 are logically equivalent to this circuit? Select all that apply. 0 points



- ☐ circuit 1
- ☐ circuit 2
- ☐ circuit 3
- ☐ circuit 4
- ☐ circuit 5

43 T/F: $A \cdot (B + C) = A \cdot B + A \cdot C$ 0 points

- ◯ True
- ◯ False
- ◯ It depends

44 The three terminals of a MOSFET transistor are: 0 points

- ○ grid, plate, cathode
- ○ gate, plate, cathode
- ○ gate, source, drain
- ○ base, collector, emitter
- ○ grid, source, drain

45 What is the product of sums solution to this truth table? Select all that apply. 0 points

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

- ☐ F = (A + ~B + C) · (~A + B + C) · (~A + B + ~C) · (~A + ~B + C) · (~A + ~B + ~C)
- ☐ F = (~A + B + ~C) · (A + ~B + ~C) · (A + ~B + C) · (A + B + ~C) · (A + B + C)
- ☐ F = (~A + ~B + ~C) · (~A + ~B + C) · (~A + B + C)
- ☐ F = (A + B + C) · (A + B + ~C) · (A + ~B + ~C)
- ☐ F = (~A)·(~B)·(~C) + (~A)·(~B)·C + (~A)·B·C

46 What is the equivalent logic expression to ~(A + ~B)? 0 points

- ○ AB
- ○ ~A~B
- ○ ~AB
- ○ A
- ○ A + B

SUBMIT

Figure 1

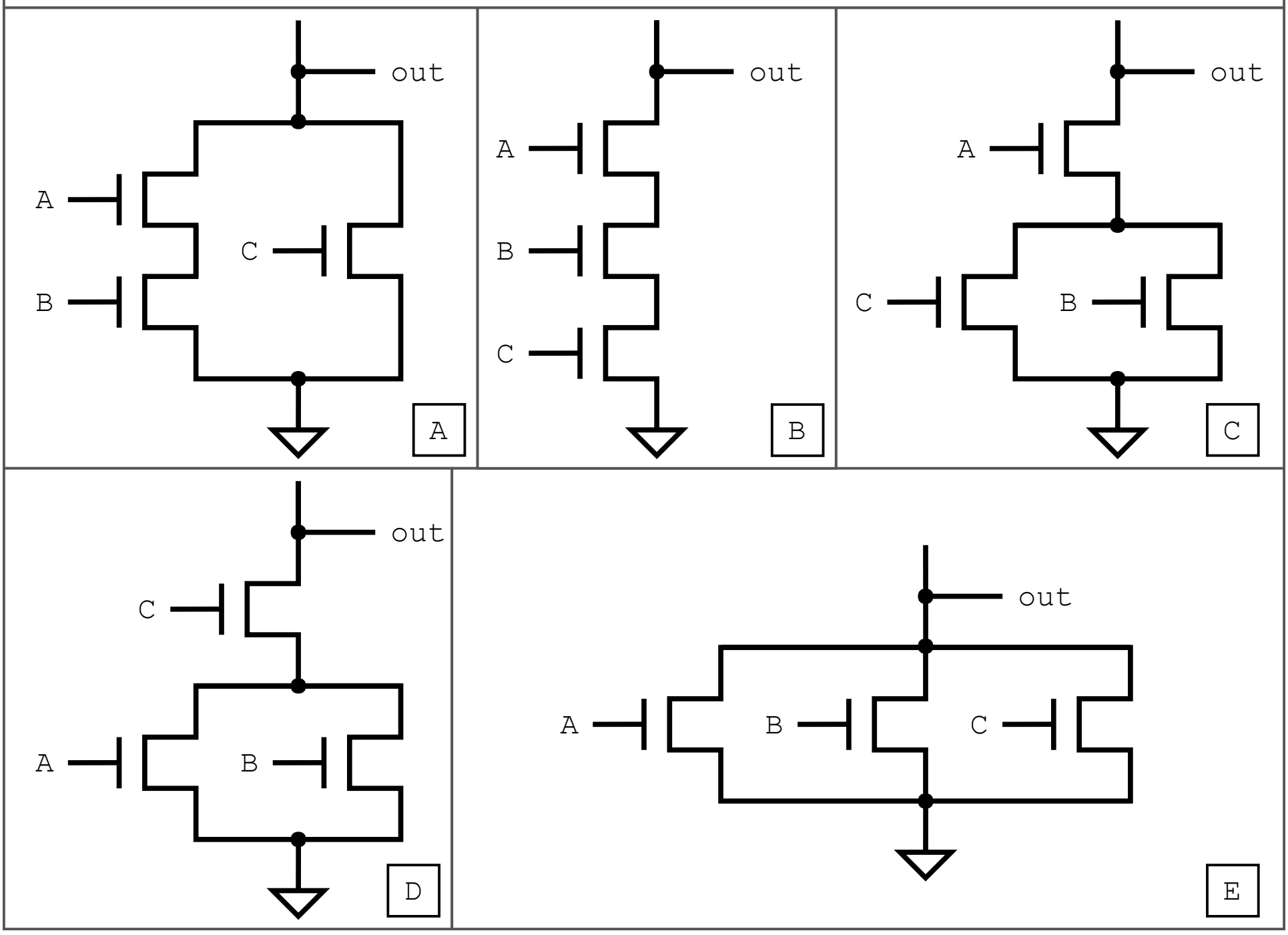


Figure 2