CMPEN 271 Sample Exam Multiple Choice Questions

Version 2.5 (Last modified: 9-5-17)
Note: the correct answer is choice "**a**" for every question.

1. Digital vs. Analog Systems (Lectures #1, 2, 2.5)

1. A digital system represents information in
   a) discrete levels b) discreet levels c) a continuous range of values d)variables

2. An analog system represents information in
   a) a continuous range of values b) discrete levels c) discreet level d) variables

3. Sampling frequency is expressed in what units?
   a. a) Hertz b) voltage c) bits d) number of bits/sample

4. The term "quantization" refers to the
   a) number of bits per sample b) number of samples per second
   c) number of bits in a byte d) number of samples per bit

5. Which of the following systems is analog?
   a) audio cassette b) HDTV c) CD player d) computer

6. What is the quantization for an audio CD?
   a) 16 bits b) 44.4KHz c) 16KHz d) 8 bits

7. The approximate sampling frequency of an audio CD is
   a) 44KHz b) 16KHz c) 8 bits d) 16 bits

8. The bits on a CD are physically represented as
   a) pits b) magnetic field c) orientation d) voltage e) charge

9. An 8-bit analog-to-digital converter (ADC) divides the input voltage into how many discrete levels?
   a) 256 b) 16 c) 8 d) 128

10. What is the approximate speed of light (EM radiation)?
    a. 1 billion feet per second
    b. 1 million feet per second
    c. 1000 feet per second
    d. 186,000 feet per second

11. Approximately how long does it take for light to travel 1 foot?
    a. a) 1 nanosecond b) 1 millisecond c) 1 microsecond d) 1 sec

12. What is the approximate speed of sound?
    a. 1000 feet per second
    b. 1 billion feet per second
    c. 1 million feet per second
    d. 186,000 feet per second

13. If a digital system uses a quantization of 8 bits and a sampling frequency of 10Hz, then what is total number of bytes stored in 2 seconds?
    a) 20 bytes b) 20 bits c) 80 bytes d) 80 bits e) 160 bytes

14. If a digital system uses a quantization of 8 bits and a sampling frequency of 10Hz, then what is total number of bits stored in 2 seconds?
    a) 160 bits b) 10 bits c) 80 bytes d) 80 bits e) 160 bytes

15. If a digital system uses a quantization of 16 bits and a sampling frequency of 1KHz, then what is total number of bytes stored in 1 second?
    a) 2000 bytes b) 2000 bits c) 16 bytes d) 16,000 bits e) 160 bytes

16. If a digital system uses a quantization of 16 bits and a sampling frequency of 1KHz, then what is total number of bits stored in 1 second?
    a) 16,000 bits b) 2000 bits c) 16 bytes d) 16000 bytes e) 160 bytes

17. If the sampling frequency is doubled for a analog to digital recording system, then the number of bits stored in 1 sec will increase by a factor of..
    a) 2 b) 4 c) 8 d) 16 e) 1

18. If the quantization is doubled from 8 bits/sample to 16 bits/sample for a analog to digital recording system, then the number of bits stored in 1 sec will increase by a factor of….
    a) 2 b) 4 c) 8 d) 16 e) 1

19. One of the key advantages of a digital system over an analog system is
    a) noise immunity b) voltage c) price d) power

20. If the sampling frequency of a digital recording system is increased, then

a) quality increases b) quality decreases c) storage requirements decrease

21. What is the range of outputs for an 8-bit analog-to-digital converter (ADC)?
    a) 0 - 255 b) 0 - 256 c) 1 - 256 d) 0 – 1023 e) 0 – 1024

22. An Arduino supports both digital inputs and digital outputs?
    a) True b) False

23. A "digital" input or output is either a logic 1 (HIGH or 5v) or logic 0 (LOW or GND or 0v)?
    a) True b) False

24. An input voltage of 5 volts is applied to a 10-bit analog-to-digital converter (ADC). What is the digital output? (Assume 0-5v range)
    a) 1023 b) 5v c) 0v d) 1024 e) 512

25. An input voltage of 4 volts is applied to a 10-bit analog-to-digital converter (ADC). What is the digital output?
    a) 818 b) 5v c) 1023 d) 1024 e) 0

26. The digital output of a 10-bit ADC is 200. What is the input analog voltage?
    b) 0.98 volts b) 5volts c) 1.0 volts d) 0 volts

27. The digital output of an 8-bit ADC is 255. What is the input analog voltage?
    a) 5 volts b) 0 volts c) 1.0 volts d) 2 volts

2. Number Systems and Codes (Lecture #3)

1. How many bits are in a byte?
   a) 8 b) 16 c) 4 d) 32

2. In the digital world, what does the prefix "K" mean?
   a) 1024 b) 1000 c) 100 d) 16

3. In the digital world, what does the prefix "M" mean?
   a) 2^20 b) 2^10 c) 2^30 d) 2^40

4. What is the range of (unsigned) values for a 5-bit number?
   a) 0 to 31 b) 0 to 32 c) 0 to 16 d) 1 to 32

5. In the hexadecimal number system, the symbol "A" has a value of
   a) 10 b) 11 c) 12 d) 13

6. In the hexadecimal number system, the symbol "B" has a value of
   a) 11 b) 12 c) 13 d) 10

7. In the hexadecimal number system, the symbol "C" has a value of
   a) 12 b) 13 c) 14 d) 15

8. In the hexadecimal number system, the symbol "D" has a value of
   a) 13 b) 14 c) 11 d) 12

9. In the hexadecimal number system, the symbol "E" has a value of
   a) 14 b) 15 c) 12 d) 13

10. In the hexadecimal number system, the symbol "F" has a value of
    a) 15 b) 14 c) 12 d) 13

11. How many unique binary codes are possible with 6 bits?
    a) 64 b) 32 c) 16 d) 128

12. What is the maximum (unsigned) positive value that can be represented with 6 bits?
    a) 63 b) 64 c) 32 d) 31

13. How many unique binary codes are possible with 10 bits?
    a) 1024 b) 1023 c) 512 d) 256

14. What is the maximum (unsigned) positive value that can be represented with 10 bits?
    a) 1023 b) 1024 c) 511 d) 512

15. The base 10 number "9.25" is equal to what base 2 number?
    a) 1001.01 b) 1000.01 c) 1001.11 d) 1001.10

16. The base 2 number "1101.11" is equal to what base 10 number?
    a) 13.75 b) 12.75 c) 13.65 d) 12.50

17. The base 8 (octal) number "17.4" is equal to what base 10 number?
    a) 15.5 b) 17.5 c) 71.5 d) 15.4

18. The base 8 (octal) number "17.4" is equal to what base 16 (hex) number?
    a) F.8 b) 1F.4 c) 1F.8 d) F.4

19. The base 16 (hex) number "2A.4" is equal to what base 10 number?
    a) 42.25 b) 26.25 c) 42.50 d) 26.50

20. The base 10 number "218" would be represented as a BCD code as
    a) 0010 0001 1000
    b) 010 001 1000
    c) 1000 0001 0010

21. The base 10 number "16" would be represented as a BCD code as
    a) 0001 0110
    b) 1111
    c) 10000
    d) 001 110

22. The base 5 number "24" is equal to what base 10 number?
    a) 14
    b) 120
    c) 54
    d) 4.8

23. Parity bits are primarily used for
    a) Error correction
    b) binary addition
    c) base 2 to base 10 conversions
    d) representing characters

24. How many unique characters can be represented with a 7-bit ASCII code?
    a) 128 b) 64 c) 256 d) 512

25. How many unique characters can be represented with a 16-bit UNICODE value?
    a) 64K b) 512 c) 16K d) 32K

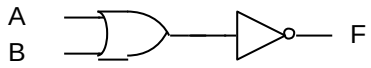
26. The value of "2 to the power 12" is equal to
    a) 4K b) 2K c) 1K d) 8K

27. Given the 7-bit ASCII code for the character ‘E’ = 1000101, then if you add an even parity bit to the msb of this character, you would get
    a) 11000101 b) 01000101 c) 10001011 d) 10001010

28. Given the 7-bit ASCII code for the character ‘E’ = 1000101, then if you add an odd parity bit to the msb of this character, you would get
    a) 01000101 b) 11000101 c) 10001011 d) 10001010

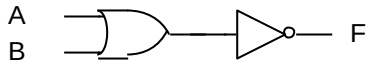
3 Logic Circuits and Truth Tables (Lecture #4)

3.1 What Boolean Function corresponds to logic circuit below?



a) F = (A+B)' b) F = A+B c) F = A' + B' d) F = A + B'

3.2 What truth table corresponds to logic circuit below?



a)

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

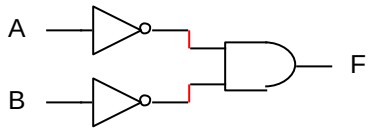
b)

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

c)

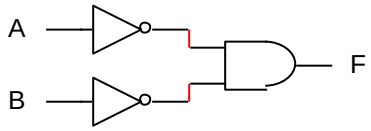
A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

3.3 What Boolean Function corresponds to logic circuit below?



a) F= A'B' b) F = (A'B')' c) F = (AB)' d) F = A' + B'

3.4 What truth table corresponds to logic circuit below?



a)

A	B	F

0	0	1
0	1	0
1	0	0
1	1	0

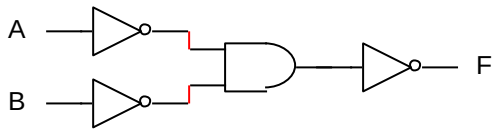
b)

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

c)

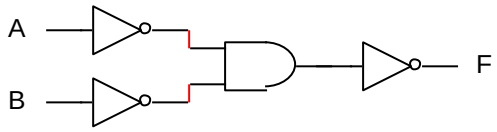
A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

3.5 What Boolean Function corresponds to logic circuit below?



a) F= (A' B')' b) F = (A'+B')' c) F = (AB)' d) F = A' + B'

3.6 What truth table corresponds to logic circuit below?



a)

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

b)

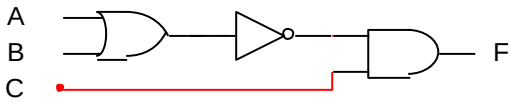
A	B	F
0	0	0
0	1	1
1	0	1
1	1	0

c)

A	B	F
0	0	1

0 1 1
1 0 1
1 1 0

3.7 What Boolean Function corresponds to logic circuit below?



a) F= (A + B)' C b) F = (A'+B') C' c) F = (AB)' + C d) F = (A + B)' + C

4. Boolean Algebra (Lecture #5)

4.1 Expression A + AB is equal to
a) A b) B c) A' d) A+B

4.2 Expression A + A'B is equal to
a) A+B b) A'+B c) A d) A'

4.3 Expression A + 1 is equal to
a) 1 b) 0 c) A d) A'

4.4 Expression A + 0 is equal to
a) A b) 1 c) 0 d) A'

4.5 Expression A + A' is equal to
a) 1 b) 0 c) A d) A'

4.6 Expression AA' is equal to
a) 0 b) 1 c) A d) A'

4.7 Expression AA' + 1 is equal to
a) 1 b) 0 c) A d) A'

4.8 Expression A + AA' is equal to
a) A b) A' c) 1 d) 0

4.9 Expression A(A' + A) is equal to
a) A b) A' c) 1 d) 0

4.10 How many unique input combinations are possible with a 3-variable function?
a) 8 b) 16 c) 4 d) 6

4.11 How many unique input combinations are possible with a 4-variable function?
a) 16 b) 32 c) 6 d) 8

4.12 DeMorgans' theorem states (A + B)' is equal to
a) A'B' b) A' + B' c) A+B d) AB

4.13 DeMorgans' theorem states (AB)' is equal to
a) A'+B' b) A'B' c) A+B d) AB

4.14 Expression A + BC is equal to
a) (A + B)(A + C) b) A(B + C) c) A + B + C d) ABC

4.15 Expression ABC + (ABC)' is equal to
a) 1 b) 0 c) ABC d) A'B'C'

4.16 Expression X'YZ(X'YZ)'

a) 0 b) 1 c) XYZ d) X + Y + Z

4.17 Expression A + AB + AC is equal to

a) A b) A + BC c) 1 d) 0

4.18 Expression X(Y + Z) is equal to

a) XY + XZ b) (X + Y)(X + Z) c) X + Y + Z d) XYZ

4.19 .Expression (X' + Y')' is equal to

a) XY b) X'Y' c) X + Y d) X' + Y'

4.20 Expression (X'Y')' is equal to

a) X + Y b) X' + Y' c) XY d) X'Y'

4.21 Express function F(A,B,C) = AB + A'BC as a sum of minterms

a) $F = \sum m (3, 6, 7)$

b) $F = \sum m (2, 3)$

c) $F = \sum m (3, 6,)$

d) $F = \sum m (0, 6, 7)$

4.22 Based on the truth table below, express the function F as a sum of minterms

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

a) $F = \sum m (0, 3, 6, 7)$

b) $F = \sum m (1, 3, 6, 7)$

c) $F = \sum m (1, 4, 7, 8)$

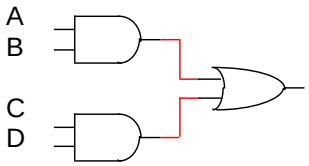
d) $F = \sum m (1, 2, 4, 5)$

5. NAND and NOR Gates (Lecture #6)

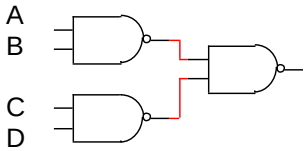
1. What is the Boolean expression for a NAND gate operation?
   a. F = (AB)'
   b. F = A'B'
   c. F = (A'B')'
   d. F = AB' + A'B

2. What is the Boolean expression for a NOR gate operation?
   a. F = (A+B)'
   b. F = A'B'
   c. F = (A' + B')'
   d. F = AB' + A'B

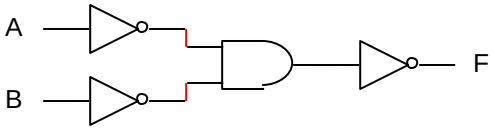
3. Convert the following circuit to minimum number of NAND gates



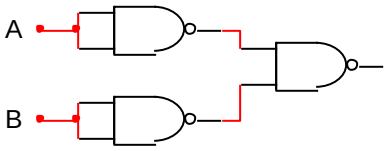
a)



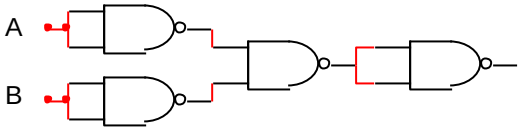
4. Convert the following circuit to minimum number of NAND gates



a)

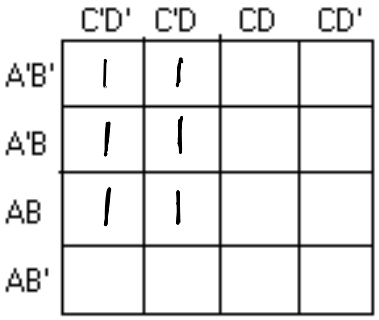


b)



6. K-Maps and Don't Cares (Lecture #7, 8)

6.1 What is the minimal function described by this K-map?

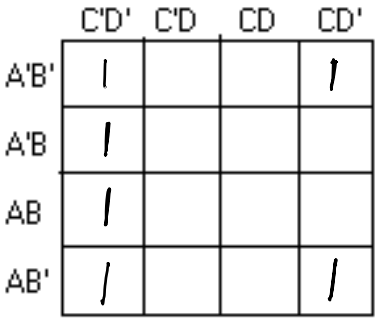


a) F = A'C' + BC'
b) F = C'D' + CD
c) F = A'B' + C'D'
d) F = AC" + B'C'
e) F = A'B'C'D' + ABC'D

6.2 Based on the K-Map above, what is F as a sum of minterms?

a) F = ∑ m (0, 1, 4, 5, 12, 13)
b) F = ∑ m (0, 1, 2, 3)
c) F = ∑ m (0, 1, 2, 3, 4, 5)
d) F = ∑ m (0, 1, 4, 5, 8, 9)

6.3 What is the minimal function described by this K-map?

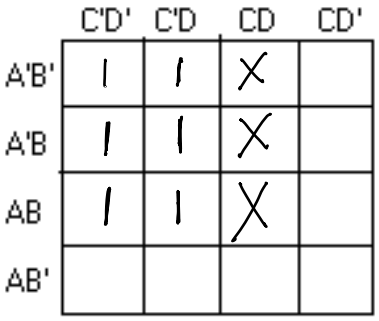


a) F = B'D' + C'D'
b) F = B' + C'D'
c) F = A'B' + B'CD'
d) F = AC + B'C'
e) F = A'B'C'D' + C'D'

6.4 Based on the K-Map above, what is F as a sum of minterms?

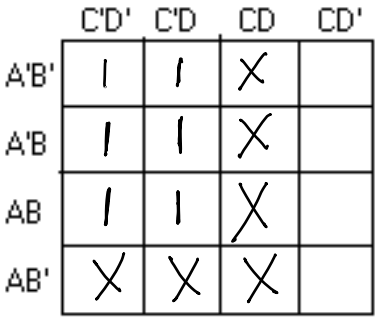
a) F = ∑ m (0, 2, 4, 8, 10, 12)
b) F = ∑ m (0, 3, 4, 9, 12, 15)
c) F = ∑ m (0, 2, 4, 8, 12, 15)
d) F = ∑ m (0, 1, 4, 5, 8, 9)

6.5 What is the minimal function described by this K-map?



a) F = A'C' + BC'
b) F = C'D' + CD
c) F = A'B' + C'D'
d) F = AC" + B'C'
e) F = A'B'C'D' + ABC'D

6.6 What is the minimal function described by this K-map?



a) F = C’
b) F = C’ + D
c) F = A’B’ + C’D’
d) F = AC’ + B’C’
e) F = A’C’ + BC’

7. XOR and XNOR (and multiple output functions) (Lecture #9)

7.1 What is the Boolean function for XOR?
a) A'B + AB' b) AB + A'B' c) A + B' d) A' + B

7.2 What is the Boolean function for XNOR?
a) AB + A'B' b) A'B + AB' c) A + B' d) A' + B

7.3. Expression "A xor 1" is equal to
a) A' b) A c) 0 d) 1

7.4 Expression "A xor 0" is equal to
a) A b) A' c) 0 d) 1

7.5 Expression "A xnor 1" is equal to
a) A b) A' c) 0 d) 1

7.6 Expression "A xnor 0" is equal to
a) A' b) A c) 0 d) 1

7.7 Expression "A xor 1" is equal to
a) A' b) A c) 0 d) 1

7.8 Expression "1 xor 0" is equal to
a) 1 b) 0 c) A d) B

7.9 Expression "0 xor 0" is equal to
a) 0 b) 1 c) A d) B

7.10 Expression "1 xor 1" is equal to
a) 0 b) 1 c) A d) B

7.11 Expression "1 xnor 0" is equal to
a) 0 b) 1 c) A d) B

7.12 Expression "0 xnor 0" is equal to
a) 1 b) 0 c) A d) B

7.13 Expression "1 xnor 1" is equal to
a) 1 b) 0 c) A d) B

7.14 Expression (A xor B)' is equal to
a) A xnor B b) A' xor B' c) A' xnor B' d) A'B'

7.15 Expression (A xor B xor C)' is equal to
a) A xor B xnor C b) A xnor B xnor C c) A xor B xor C d) A + B + C

7.16 Express (A xor B xnor C)' is equal to

a) A xor B xor C b) A' xor B' xor C' c) A xor B xnor C d) A + B + C

7.17 Expression (A xor B xor C xor D)' is equal to

a) A xnor B xnor C xnor D b) A xnor B xnor C xor D

c) A xor B xor C xor D

7.18 Express F = A xor B as a sum of mintemrs

a) F = ∑ m (1, 2) b) F = ∑ m (0, 1, 2, 3) c) F = ∑ m (0, 3)

7.19 Express F = A xnor B as a sum of mintemrs

a) F = ∑ m (0, 3) b) F = ∑ m (0, 1, 2, 3) c) F = ∑ m (1, 2)

7.20 Express F = A xor B xor C as a sum of mintemrs

a) F = ∑ m (1,2,4,7) b) F = ∑ m (0,3,5,6) c) F = ∑ m (1,3,5,7)

7.21 Consider a circuit which generates an even parity bit for a 3-bit (A, B, C) input message. The output function for the parity bit P would be

a) P = A xor B xor C b) P = A xor B xnor C c) P = (A xor B xor C)'

7.22 Consider an odd parity error detector circuit which has 4 inputs (P, A, B, C) where P is an odd parity bit, and A, B, C are data bits. There is one output F. The circuit generates an output of 1 if there is a parity error detected, and generates an output of 0 if there is no parity bit error detected. What is output function F?

a) F = P xnor A xnor B xnor C b) F = P xor A xor B xor C

c) F = A xor B xor C

7.23 Consider a circuit which adds 2, 2-bit numbers together and produces the sum as the output. How many inputs would the circuit have? How many outputs?

a) 4 inputs, 3 outputs b) 4 inputs, 4 outputs c) 2 inputs, 6 outputs

7.24 Consider a circuit which multiplies a 3-bit input number by the value of 5. As an example, if the input is 100(4), then the output would be 10100 (20). How many inputs would the circuit have? How many outputs?

a) 3 inputs, 6 outputs b) 3 inputs, 4 outputs c) 3 inputs, 5 outputs.

7.25 What Boolean function is equivalent to the circuit below?

Hint: do algebraically or do truth table and find minterms and simplify.

a) A + B b) AB c) A' + B' d) A'B' e) (A + B)'

8. IC Technology (Lecture #10)

8.1 What does the term VLSI mean?
- a) Very Large Scale Integration
- b) Verilog Language Scalable Integration
- c) Very Large System Integrator
- d) Virtual Laboratory System Integration

8.2 An electromechanical relay acts as a
- a) switch b) amplifier c) diode d) resistor

8.3 The "ideal" characteristics of a digital circuit are
- a) low power, small propagation delay
- b) low power, large propagation delay;
- c) high power, small propagation delay
- d) high power, large propagation delay

8.4 What does the term "ASIC" mean?
- a) Application Specific Integrated Circuit
- b) Advanced System Integrated Circuit
- c) Application System Integrated Circuit

8.5 Approximately how many gates are contained in a MSI integrated circuit?
- a) 10 to 100 b) 1 to 10 c) 100 to 1000 d) more than 1000

8.6 A transistor can be described as a(n)
- a) electronic switch b) electro-mechanical switch c) diode d)resistor

8.7 Which IC technology consumes the least power?
- a) CMOS b) TTL c) ECL

8.8 Which IC technology is sensitive to static electricity?
- a) CMOS b) TTL c) ECL

8.9 Moore's law states that the number of transistors in an IC doubles (as well as PC power).
- a) every 18 months or 2 years b) every month c) every 5 years
- d) every 10 years

8.10 The sterile environment required to fabricate integrated circuits is called a(n)
- a) clean room b) surgical room c) rinse lab

8.11 The crystal material with which semiconductors and IC are made is
- a) silicon b) copper c) aluminum d) plastic