1.Calculate the time needed to transmit a file of 64 KB with 512 kbps.

Solution

64 KB = 512 kb

Dt = 512 kb / 512 kbps = 1 s

2.Calculate the time needed to transfer a file of 700 MB with 200 kbps.

Solution

700 MB = 8* 700 * 1024 kb = 5734400 kb

Dt = 700 MB / 200 kbps = 5734400/200 s = 28672 s

Dt = 28672 s / 3600 s / h = 7h 57'52''

7 h = 25200 s

57 min = 3420 s

52 s

3.Which of the following blocks are components of the communication system?

Signal Source

Transmitter

Communication Channel

Receiver

4.Which of the following signal sources use the narrowest bandwidth?

voice

audio

video

TV

5.Which of the following communication types are wireless?

Optical Communication

IR Communication

Radiocommunication

TV Cable Broadcasting

6.Which is the voice channel bandwidth for
a classical phone system?
1 kHz
4 kHz
7 kHz
12 kHz

7.Choose the correct value of the bandwidth
for HD Voice:
1 kHz
4 kHz
7 kHz
12 kHz

8.What is the meaning of the
following abreviations?
• ASCII - **American Standard Code for Information Interchange**
• BER - **Bit Error Rate**
• CRC - **Cyclic Redundancy Check**
• FDD - **Fiber Digital Device**
• SNR - **Signal-to-Noise Ratio**

9.• *Calculate the dB value of the signal-to noise ratio if the received video signal power is 10 nW and the noise power is 0.1 pW.*

• *How do you appreciate the quality of the received signal?*

Solution

• **S = 10 nW = 10*10 ^(-9) W = 10 ^(-8) W**

• **N = 0.1 pW = 10 ^(-1) * 10 ^(-12) W =**

= 10 ^(-13) W

• **S/N = 10 ^ 5**

• **S/N (dB) = 10 x lg (10 ^ 5) = 50 dB**

• **QoS: Excellent**

10. *What do the abbreviations below mean?*

•*CDMA -* **Code Division Multiple Access**

•*FSK -* **Frequency Shift Keying**

•*QAM -* **Quadrature Amplitude Modulation**

•*OFDM -* **Ortoghonal Frequency Division Multiplexing**

•*DSSS -* **Direct-Sequence Spread-Spectrum**

•*FHSS –* **Frequency Hopping Spread-Spectrum**

11.*Which of the following blocks are components of the receiver?*

synchronizing circuit

equalizer

modulator

transceiver

12.*Which of the following data encoding techniques reduce the informational source redundancy?*

compression

encryption

error-correction

line coding

13.What is the purpose of a synchronizing circuit?

To reduce the signal distortions caused by the communication channel

To correct the phase of the carrier signal in the receiver

To spread the spectrum of the transmitted signal

To reduce the interferences between channels

14.Which of the following techniques modulate the amplitude of the carriers?

AM

ASK

FM

QAM

15.What is the goal of DSSS and FHSS techniques?

to compress the signal

to correct transmission errors

to equalize the channel

to spread the transmitted signal spectrum

16.What do the abbreviations mean?

ADC **Adaptive Data Compression**

PCM **Pulse Code Modulation**

DPCM **Differential Pulse Code Modulation**

ADPCM **Adaptive Differential Pulse Code Modulation**

DCT **Discrete Cosine Transform**

JPEG **Joint Photographic Experts Group**

MPEG **Moving Picture Experts Group**

17.The operation that rounds the samples' values of a signal to a finite set of levels is called:

quantization

sampling

filtering

coding

18.The operation of 'reading' the signal at discrete moments is called:

quantization

sampling

filtering

coding

19.In order to maintain a constant quantization SNR, the quantum must be:

Adapted to the signal

Increased

Decreased

Constant

20.Nyquist frequency is equal to:

The maximum frequency of the signal spectrum

The maximum frequency's double value of the signal spectrum

The signal's bandwidth

The cut-off frequency's double value of the pre-sampling LPF

21.DCT is used for:

lossless compression algorithms

loss compression algorithms

error-correction techniques

equalizing techniques

22.What can be used for audio compression?

JPEG

MPEG-1

MPEG-2

MPEG-4

23.Which of the following algorithms are used for HDTV?

JPEG

MPEG-1

MPEG-2

MPEG-4

24.Which of the following algorithms are used for 3D image compression?

JPEG

MPEG-1

MPEG-2

MPEG-4

25.Which of the following algorithms mark the multimedia files with a digital signature ?

MPEG-1

MPEG-2

MPEG-4

MPEG-7

26.The bit-sequence 00000111 is encrypted by RSA algorithm with the PK (3, 391). Calculate the encrypted binary sequence.

Answer

Input: 00000111

m=7, e=3, n=391

c=m^e (mod-n)=7^3 = 343 (mod-391)

101010111

27.•*Apply the permutation vector [3 1 2 4] on the character sequence [e t t i].*

•*Apply the inverted permutation on the resulted sequence and check the result.*

Answer

•[3 1 2 4] = [c3, c1, c2, c4]

•[e t t i] = [c1, c2, c3, c4] becomes [t e t i]

•[2 3 1 4] = [c2, c3, c1, c4]

•[t e t i] becomes [e t t i].

28.*Which of the following algorithms use private encryption keys?*

AES

DES

IDEA

RSA

29.*How many iterations does DES algorithm run?*

1

4

10

16

30.*Which of the following statements are true?*

RSA is a loss compression technique

RSA uses public encryption keys

RSA processes decimal values

RSA is used by JPEG

31.*Which of the following codes is applied on binary sequences?*

ASCII

AES

DES

RSA

32.Which of the following values can be used as an RSA encryption exponent when p=7 and q=11?

3

5

7

11

33.How do we calculate the multiplication of two symbols in GF(2m):

by multiplying the symbols' polynomials and reducing the result modulo-p(x) (p(x) is the m-order primitive polynomial)

modulo-2 bit-by-bit

modulo-m

using the exponential expression of the symbols

34.Calculate 5+6 in GF(8) and tick the result:

0

1

2

3

4

5

6

7

35. Calculate 2x7 in GF(8) and tick the result:

0

1

2

3

4

5

6

7

PGF8 = [0   0   0   0   0   0   0   0;
          0   1   2   3   4   5   6   7;
          0   2   4   6   3   1   7   5;
          0   3   6   5   7   4   1   2;
          0   4   3   7   6   2   5   1;
          0   5   1   4   2   7   3   6;
          0   6   7   1   5   3   2   4;
          0   7   5   2   1   6   4   3];

36. What is the value of the expression 2+3*5 in GF(8)?

0

1

2

3

4

5

6

7

PGF8 = [0   0   0   0   0   0   0   0;
          0   1   2   3   4   5   6   7;
          0   2   4   6   3   1   7   5;
          0   3   6   5   7   4   1   2;
          0   4   3   7   6   2   5   1;
          0   5   1   4   2   7   3   6;
          0   6   7   1   5   3   2   4;
          0   7   5   2   1   6   4   3];

37. What is the value of 6/5 in GF(8)?

0

1

2

3

4

5

6

7

PGF8 = [0   0   0   0   0   0   0   0;
          0   1   2   3   4   5   6   7;
          0   2   4   6   3   1   7   5;
          0   3   6   5   7   4   1   2;
          0   4   3   7   6   2   5   1;
          0   5   1   4   2   7   3   6;
          0   6   7   1   5   3   2   4;
          0   7   5   2   1   6   4   3];

38.•*Calculate the value of the following expression in GF(8):*
(5+3*4+6^7)/2
ANSWER:
 3*4=2^3*2^2=2^5=7 ,
 6^7=1,
 5+7+1=101+111+001=011=3
 3/2=(2^3)*2^(-1)=2^2=4

39.*Which of the following algorithms use public encryption key?*
AES
DES
EL-GAMAL
RSA

40.*Which of the following statements about AES are true?*
AES is a private-key algorithm
AES is a public-key algorithm
AES is a symmetrical encryption algorithm
AES is a compression algorithm

41.*Fill in the blanks with the steps of AES algorithm:*
1.<u>**SubBytes**</u>
2.<u>**Shift Rows**</u>
3.<u>**MixColumns**</u>
4.<u>**AddRoundKey**</u>

42.*How many iterations does AES run?*
10
12
14
16

43.In GF(16), the length of the vectors on which DFT can be applied is:

3

5

7

15

44.Which of the following codes is applied on bit sequences?

ASCII

HAMMING

TURBO-HAMMING

RS

45.Error detection is based on:

Generator matrix (G)

Control matrix (H)

Error vector (e)

Syndrome vector(s)

46.How many errors can H(31,26) code correct?

1

2

3

5

47.What is the value of the minimum Hamming distance of H(15,11) code?

1

3

4

11

48.Calculate the coding rate of TH(15,11) code:

Rc = 112/152 = 121/225 ~ 1/2

49.*Which of the following statements about Turbo code are true?*

Turbo code encodes data using an interleaving structure

Turbo decoder works iteratively

Turbo code has the same error correcting capacity as the basic code

Turbo code corrects more errors than the basic one.

 50.*Which of the following codes can be used to correct error-burst?*

ASCII with parity bits

Hamming

RS

Turbo-Hamming

51.*Design a Turbo-RS code on GF(256) for a 100 Mbps communication channel with maximum 1ms fading duration.*

Solution:

•No. of bit errors = 10^(-3)*10^8=100000 bits

•No. of Byte errors = 100000/8+2=12502 Bytes

•Turbo-RS code: n = 255, n*t > 12502, t=[12502/255]+1 = 50 => n-2t=155 =>

Basic code: RS(255, 155).

52.*Line codes are used for:*

data compression

data encryption

error correction

bit timing

53. Which of the following line codes associate
the input bits with signal levels?
NRZ-M
RZ
Manchester
MILLER

54. Which of the following codes use a ternary output alphabet?
AMI
BIF-M
HDB3
MILLER

55. Which of the codes below have a coding rate equal to 1:1?
AMI
BIF-M
MILLER
NRZ-M

56. The following bit sequence
1 0 0 0 0 0 1 1 0 0 0 0 0 1 is encoded as
+ 0 0 0 0 0 - + 0 0 0 0 0 -.

What line code is used in this case?
AMI
BIPOLAR 2
HDB3
HDB4

57.What do the abbreviations below mean?

•BER **Bit Error Rate**

•PER **Packet Error Rate**

•BIF-M **Biphase - Mark**

•RZ **Return to Zero**

•AMI **Alternative Mark Inversion**

58.How many bits are used to define a state of a 16-QAM modulator?

2

4

8

16

**59**.Why is Gray coding technique used to map the states of a digital modulator?

To reduce the demodulator BER.

To increase the transmitted bit rate.

To maintain a Hamming distance equal to 1 between the bit sequences which identify neighboring states.

To increase the Hamming distance between the bit sequences which identify neighboring states.

60.Read the value of SNR corresponding to a value of BER of about 10^{-8}.
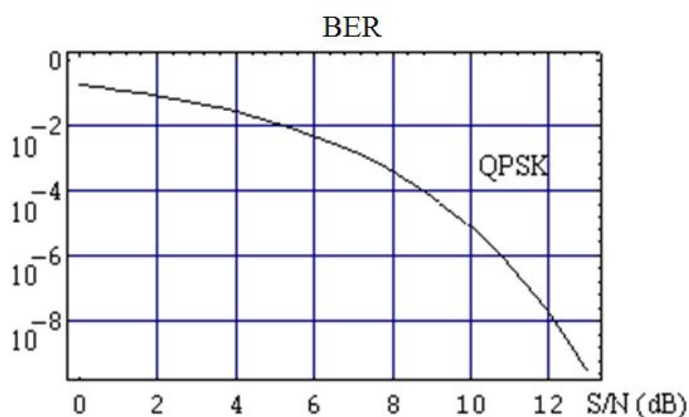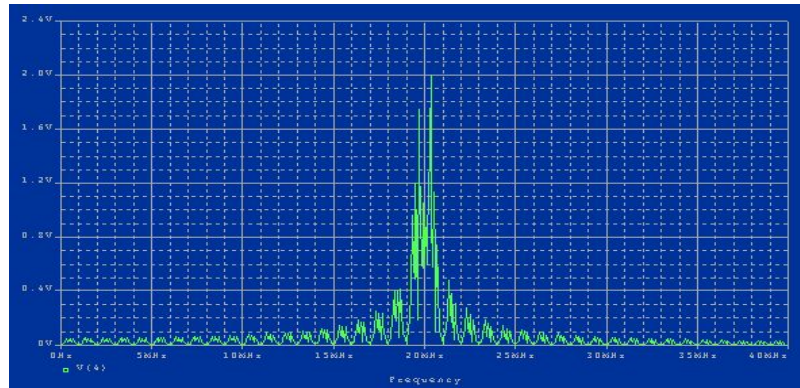

Răspuns
SNR ~ 12 dB

61.*Which of the following modulation techniques can produce the p.s.d. plotted below?*
DSB-AM
Unipolar ASK
BPSK
BFSK

62.*Which of the following modulation techniques is used by a broadband communication system?*
FSK
4-ASK
16-QAM
32-PSK

63.*Which of the following modulation techniques can be used by a high-speed communication system?*
4-FSK
8-ASK
32-PSK
64-QAM

 64.*Which of the following modulation techniques maintain a constant envelope?*
4-FSK
8-ASK
32-PSK
MSK

65.*Which of the following techniques represents a digital amplitude modulation?*

AM

BFSK

16-QAM

SFSK

66.*Which of the following techniques allows the using of an envelope detector in order to demodulate the signal?*

DSB-AM m<1

BFSK

8-ASK

16-QAM

67.*What is the spectral efficiency equal to for a 50 Mbps communication channel having a bandwidth of 20 MHz?*

0.4 b/s/Hz

2 b/s/Hz

2.5 b/s/Hz

5 b/s/Hz

68.*What is value of the period of a PRBS generated by a LFSR with 5+1 feedback connection?*

7

15

31

63

69.*What type of modulator is used to generate a FHSS signal?*

amplitude

phase

frequency

pulse position

70. What is the value of the spreading gain of a FHSS modulator if the bandwidth is 16 times spread?

4 dB

12 dB

16 dB

32 dB

71. Let us consider a DSSS modulator that generates the sequence 1110100 in a period. The input data sequence of the modulator is 1010. Each data bit corresponds to one PR bit. Which is the output sequence of the modulator?

0100

0101

1010

1110

72. What are the advantages of the spread spectrum modulations?

They use a larger transmission bandwidth.

They minimize the effects of additive jamming noise.

They are used to ensure multiple access by the communication channel.

They simplify the receiver structure.

73. What is the maximum allowed length of a UTP cable segment?

100m

200m

500m

5 km

74. On an area with EMI, what cable can be used ?

coaxial

optical

STP

UTP

75.A radio-communication system works on 0.7 GHz, with identical radiating and receiving half-wavelength dipole antennas, positioned at a distance of 4 km, with an antenna efficiency of 70%, and the input power of 100 mW, on a bandwidth of 20 MHz (PLF = 0 dB).
Compute the free-space path power loss, the received power and the received SNR in dB.

Solution
D=2.4, G = 0.7x2.4=1.68
GT = GR = 2.25dBi, PE = 0.1 W = -10 dB
L = 32.44 + 20log10(4)+20log10(700) = 101.34 dB
PR(dB) = -10 + 2.25+2.25 – 101.34 = -106.84 dB
Nin = kT0B = 1.38 * 10^(-23)*290*20*10^6=
= 8*10^(-17) W => Nin(dB)= -169 dB
SNRrec = PR(dB)- Nin(dB)=62.25 dB

76. What connector type is used for a UTP cable?
BNC
RJ-11
RJ-12
RJ-45

77. Which of the following antennas are omnidirectional?
Dipole
Mast radiator
Phased array
Whip antenna

78. Which of the following radiators are directional antennas?
Cassegrain Antenna
Circular Antenna Array
Monopole Antenna
Parabolic Antenna