

ELEX 4550 : Wide Area Networks
Term 201730

FINAL EXAMINATION
9:00 AM – 12:00 PM
December 14, 2017

This exam has seven (7) questions on eight (8) pages. The marks for each question are as indicated. There are a total of 20 marks. Answer all questions. Write your answers and all rough work in this paper and nowhere else. Show your work. Draw a box around your final answer. Numerical answers must include units. Books and notes are allowed. No electronic devices other than calculators are allowed. Show your work.

This exam paper is for:

Exam 1 A00123456

Each exam is equally difficult.
Answer your own exam.

Do not start until you are told to do so.

Name: _____
BCIT ID: _____
Signature: _____

Question	Mark	Max.
1		3
2		4
3		2
4		2
5		4
6		2
7		3
Total		20

Question 1 (3 marks)

Answer each of the following *briefly*:

- (a) Does the loop current increase or decrease when a telephone set goes off-hook?
- (b) Are the voltages on a POTS loop typically negative or positive with respect to ground?
- (c) Are DTMF tone frequencies multiples of one frequency (i.e. are they harmonically related)?

Question 2 (4 marks)

Answer each of the following *briefly*:

- (a) Would PPP's NCP protocol be used to control the use of compression over the link?
- (b) How could sending a DHCPDISCOVER frame result in multiple DHCPOFFER responses?
- (c) When does a DHCP client typically renew an address lease?
- (d) Why might a router not pass ICMP echo requests?

Question 3 (2 marks)

Answer each of the following *briefly*:

- (a) How many conventional (64 kbps PCM) phone calls can be carried by an STS-1 link?
- (b) Which of the following does a web server's TLS certificate typically contain (you may include any number of items in your response):
 - (i) a public key
 - (ii) a private key
 - (iii) identification information
 - (iv) a signature

Question 4 (2 marks)

You need to digitize an ultrasonic signal that contains frequencies from DC to 100 kHz. You need to ensure the quantization noise is about 60 dB less than the signal power. What are the minimum sampling rate and ADC resolution you could use? *Note: you may use the approximation for quantization noise vs. number of bits.*

Question 5 (4 marks)

A communication system using DMT (OFDM) uses a sampling rate of 8 MHz and 128-sample blocks (symbols). A guard time of 4 μ s is left between DMT symbols for a cyclic extension.

- (a) What is the DMT symbol duration, not including the guard time?

- (b) What is the frequency spacing between DMT subcarriers?
- (c) What is the DMT symbol rate (including the guard time overhead)?
- (d) If half of the subcarriers are used and each subcarrier transmits 4 bits, what is the bit rate? Include the guard time overhead.

Question 6 (2 marks)

An HFC system has a 33-meter co-ax drop from an 4-way splitter to a subscriber. The loss of the co-ax is 9 dB/100m. Assume the splitter is ideal (the sum of output powers is equal to the input power).

- (a) What splitter input power level would ensure the subscriber sees 0 dBmV? Give your answer in dBmV.
- (b) Assuming 75 ohm co-ax cable, what is the corresponding level in dBm?

Question 7 (3 marks)

An authoritative DNS server is configured with the following resource records (shown in BIND format):

```
example.com. NS 192.0.2.2
example.com. MX 10 mail.example.com.
www.example.com. A 11.1.2.3
```

What type of resource record and value(s) would be included in responses to the following nslookup commands, if any? Give only the answer to the request, not the name/address of the responding DNS server or any “related records.”

- (a) nslookup example.com
- (b) nslookup -type=mx example.com
- (c) nslookup -type=ns example.com

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 - (iii) identification information
 - (iv) a signature

Question 4 (2 marks)

You need to digitize an ultrasonic signal that contains frequencies from DC to 50 kHz. You need to ensure the quantization noise is about 36 dB less than the signal power. What are the minimum sampling rate and ADC resolution you could use? *Note: you may use the approximation for quantization noise vs. number of bits.*

Question 5 (4 marks)

A communication system using DMT (OFDM) uses a sampling rate of 4 MHz and 64-sample blocks (symbols). A guard time of 4 μ s is left between DMT symbols for a cyclic extension.

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