HW #3: Networking Questions

Spring 2022

Yuxuan Yang (yy340)

Submit electronically as a PDF file called `hw3_netID.pdf` on Gradescope
(see course website for due date)

Note: This assignment includes a written portion (this document) and a programming portion (separate document). Be sure to submit both!

1. **Bit Stuffing.**

a. A bit string, 1000111111010001111101l, needs to be transmitted at the data link layer. What is the string transmitted across the Link after bit stuffing by the sender? Assume the same start/end flags as the ones used in class.

01111110 100011111 **0** 10100011111 **0** 011 01111110

b. A frame is received by the data link layer, which was transmitted using bit stuffing: 01111110111111011000111110110111111 0. What is the bit string that the link layer passes up the stack to the network layer after bit de-stuffing?

11111110001111111

2. **Hamming Code.**

a. Encode the message 10011011 to send. m=8 => r=4 _ _1_001_1011 =>011000111011

b. What can be said about the correctness of the following received messages (Hint: Check for Hamming Code correctness using parity)?

i. 111000101011 error happened at 111000101011 =>111000100011

ii. 01110011011 error happened at 011100110111 =>01110011010

3. **CRC Code.** Assume the $C(x) = x^4 + x^2 + 1$. 10101

a. Encode the message 10110 with CRC. 101101111

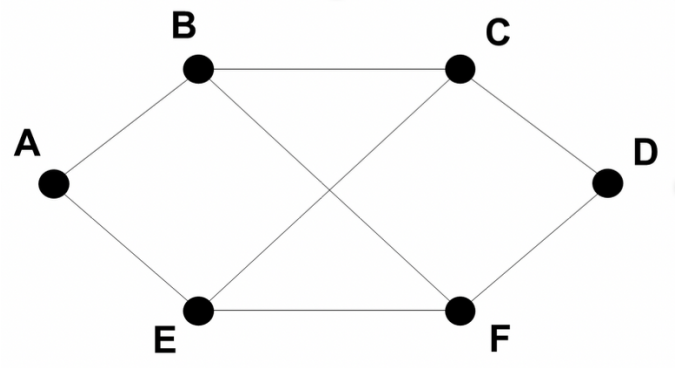
b. What can be said about the correctness of the following received messages?

i. 110101110 110101100

ii. 110101100 correct

```
  10011
101100000
10101
 00110000
 00000
  0110000
  00000
   110000
   10101
    11010
    10101
     1111
```

4. **Distance Vector Routing. Distance Vector Routing.** Consider the subnet shown below. Distance vector routing is used, and the following distance vectors have just come in to router C: **B**: (6, 0, 8, 10, 5, 5); from **D**: (4, 9, 7, 0, 8, 6); and from **E**: (7, 7, 4, 8, 0, 5). The measured distances/costs from C to **B**, **D**, and **E** are 5, 5, and 4, respectively. What will C's new routing table be after this update? Show both the outgoing router to use and the cost.



CBA = 5+6=11
CEA = 4+7=11
CDF = 5+6=11
CEF = 4+5=9

Routing Table Format:

Destination	Cost	Next Hop
A	11	B/E
B	5	B
C	0	--
D	5	D
E	4	E
F	9	E

5. **TCP Sequence Numbers.** To get around the problem of sequence numbers wrapping around while old TCP packets still exist, TCP could use 64-bit sequence numbers instead of 32 bits. However, theoretically, an optical fiber can run at 100 Terabits per second. What maximum packet lifetime would be required to prevent sequence number wrap-around even with 64-bit sequence numbers? Assume that each byte of a packet has its own sequence number (as TCP does). $\frac{\text{size}=2^{64}*8 = 2^{67}}{100*2^{40}}$ = 1342177.28 second (15.53day)

6. **DNS.** Using an online whois lookup service like whois.net, look up duke.edu. On what date was the domain registered? When does it expire? What are the DNS servers for this domain? Include a screenshot of your source.

7. **Internet Services.** Using netcat (the 'nc' command) in a terminal, manually display the following URL to the console.
http://rabihyounes.com/awesome.txt

Answer for 6.
Domain record activated: 02-Jun-1986
Domain record last updated: 02-Jun-2021
Domain expires: 31-Jul-2024
Name Servers:
DNS-AUTH-02.OIT.DUKE.EDU
DNS-NC1-01.OIT.DUKE.EDU
DNS-AUTH-01.OIT.DUKE.EDU

duke.edu

Updated 2 days ago

```
This Registry database contains ONLY .EDU domains.
The data in the EDUCAUSE Whois database is provided
by EDUCAUSE for information purposes in order to
assist in the process of obtaining information about
or related to .edu domain registration records.

The EDUCAUSE Whois database is authoritative for the
.EDU domain.

A Web interface for the .EDU EDUCAUSE Whois Server is
available at: http://whois.educause.edu

By submitting a Whois query, you agree that this information
will not be used to allow, enable, or otherwise support
the transmission of unsolicited commercial advertising or
solicitations via e-mail.  The use of electronic processes to
harvest information from this server is generally prohibited
except as reasonably necessary to register or modify .edu
domain names.

-----------------------------------------------------------

Domain Name: DUKE.EDU

Registrant:
        Duke University
        905 W. Main Street, Suite 18B
        Suite 2106
        Durham, NC 27701
        USA

Administrative Contact:
        Domain Administrator
        Duke University
        334 Blackwell St.
        Suite 2106
        Durham, NC 27701
        USA
        +1.9196845300
        datacom-hostmaster@duke.edu

Technical Contact:
        Domain Administrator
        Duke University
        334 Blackwell St.
        Suite 2106
        Durham, NC 27701
        USA
        +1.9196842200
        datacom-hostmaster@duke.edu

Name Servers:
        DNS-AUTH-02.OIT.DUKE.EDU
        DNS-NC1-01.OIT.DUKE.EDU
        DNS-AUTH-01.OIT.DUKE.EDU

Domain record activated:    02-Jun-1986
Domain record last updated: 02-Jun-2021
Domain expires:             31-Jul-2024
```

```
dianyu@dianyu-XPS-15-9550:~$ echo -en "GET /awesome.txt HTTP/1.1\r\nHost: rabihyounes.com\r\nUserAgent: nc/0.0.1\r\nAccept: */*\r\n\r\n" | netcat rabihyounes.com 80
HTTP/1.1 200 OK
Date: Sat, 26 Feb 2022 17:04:21 GMT
Server: Apache
Upgrade: h2,h2c
Connection: Upgrade
Last-Modified: Fri, 08 Feb 2019 18:43:41 GMT
Accept-Ranges: bytes
Content-Length: 2360
Cache-Control: max-age=21600
Expires: Sat, 26 Feb 2022 23:04:21 GMT
Vary: Accept-Encoding
host-header: c2hhcmVkLmJsdWVob3N0LmNvbQ==
X-Endurance-Cache-Level: 3
X-nginx-cache: WordPress
Content-Type: text/plain
```

```
dianyu@dianyu-XPS-15-9550:~$
```