Computer Networks 2021 Exercises - Unit 5

FAN: worr0028

NOTE: Each student's work unit is unique. You *must* use the work that has been generated for your FAN. If you do not, then you will fail this work unit.

NOTE: You must record your answers in the answer file EXACTLY as required, and commit and make sure your changes have been pushed to the github server, as they will otherwise not be counted.

NOTE: The topic coordinator will periodically run the automatic marking script, which will cause a file called unit5-results.pdf to be updated in your repository. You should check this file to make sure that your answers have been correctly counted. That file will contain the time and date that the marking script was last run, so that you can work out if it has been run since you last changed your answers. You are free to update your answers as often as you wish, until the deadline for the particular work unit.

1 TCP/IP And Related Protocol Packet Formats and Header Fields

For each question, you must record your answer in the unit5-answers.txt file in your git repository. Templates for each answer are provided in unit5-answers.txt *for your convenience.*

You will find information on the packet header formats in many places, including:

- *https://en.wikipedia.org/wiki/Ethernet_frame#Header*

- *https://en.wikipedia.org/wiki/IPv4#Header*

- *https://en.wikipedia.org/wiki/Address_Resolution_Protocol*

- *https://en.wikipedia.org/wiki/Transmission_Control_Protocol#TCP_segment_structure*

- *https://en.wikipedia.org/wiki/User_Datagram_Protocol#UDP_datagram_structure*

Considering the following packet:

```
# 0x0000:   9762 3207 3cda af75 673b a7af 0800 4500   .b2.<..ug;....E.
# 0x0010:   0060 0000 0000 3206 0000 dab1 ff7a a073   .`....2......z.s
# 0x0020:   deca 378b a4d4 7b5a c4e5 138c 8158 50a1   ..7...{Z.....XP.
# 0x0030:   c23b 0000 0003 3176 66a5 f568 b780 d9cd   .;....1vf..h....
# 0x0040:   ce0d 5afd 424c dd0f 71ac 777b 5154 6939   ..Z.BL..q.w{QTi9
# 0x0050:   c1db 54cf bc8c 81fe ee75 8eea b1cc 72d1   ..T......u....r.
# 0x0060:   cb0e 1f33 db31 98f6 5b22 1118 938e        ...3.1..["....
```

Find the value of the following fields:

Question ID	Field	Type
ab	TCP SYN	Boolean: Answer Y or N
ac	IP DSCP	Integer: Answer with the decimal value of the field.
ad	IP FLAGS	Integer: Answer with the decimal value of the field.
ae	TCP PSH	Boolean: Answer Y or N
af	IP length	Integer: Answer with the decimal value of the field.
ag	TCP sequence number	Integer: Answer with the decimal value of the field.

Considering the following packet:

```
# 0x0000:   7261 4e27 d97e 0df6 ca53 98dd 8100 0939   raN'.~...S.....9
# 0x0010:   0800 4500 0093 0000 0000 3506 0000 0696   ..E.......5.....
# 0x0020:   8c06 7104 8c97 0026 f2a5 6a24 0176 0712   ..q....&..j$.v..
# 0x0030:   5dd5 508d 7269 0000 0008 a809 156b afa2   ].P.ri.......k..
# 0x0040:   d9f5 5002 e4cf 478a ab8e 8431 a89c d751   ..P...G....1...Q
# 0x0050:   f49e 31b1 fcf3 1447 2e3d 5a73 92b9 51d7   ..1....G.=Zs..Q.
# 0x0060:   1181 ba59 24b9 067a e6e7 5a57 a838 1f43   ...Y$..z..ZW.8.C
# 0x0070:   a23e 9db5 c5d7 edbb aba0 22ba a8d0 1db8   .>........".....
# 0x0080:   5d01 53aa d31f 208e 3f21 3865 96e1 a5ec   ].S.....?!8e....
# 0x0090:   79c6 c80a 2c4c 99f0 f852 9df0 721b 65b3   y...,L...R..r.e.
# 0x00a0:   2e34 8a44 df                              .4.D.
```

Find the value of the following fields:

Question ID	Field	Type
ah	TCP RST	Boolean: Answer Y or N
ai	TCP window size	Integer: Answer with the decimal value of the field.
aj	Frame is 802.1ad	Boolean: Answer Y or N
ak	TCP FIN	Boolean: Answer Y or N
al	TCP PSH	Boolean: Answer Y or N
am	IP Protocol of payload	Integer: Answer with the decimal value of the field.

Considering the following packet:

```
# 0x0000:   f676 bdd0 dd3c 41ca fd49 d661 0800 4500   .v...<A..I.a..E.

# 0x0010:   0050 0000 0000 1011 0000 44c9 4ba3 0684   .P........D.K...

# 0x0020:   0b2a 4a43 bb8c 0030 0c2a 2f8f 7a8d 22ca   .*JC...0.*/.z.".

# 0x0030:   270a 196b 8d5d 0ef0 3f16 1c14 700e 0e01   '..k.]..?...p...

# 0x0040:   ce77 3af5 c4c9 91d9 02a1 6db0 6618 b0bb   .w:.......m.f...

# 0x0050:   7cbc 5d9d 1ef8 d32b a60e 056f 4097        |.]....+...o@.
```

Find the value of the following fields:

Question ID	Field	Type
an	ETH source address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
ao	Frame is 802.1q	Boolean: Answer Y or N
ap	ETH frame type	Four-digit Hex: Answer with the four digit hexadecimal value of the field, e.g., 02AF. Do not put a leading 0x or $ on the front of the hexadecimal number.
aq	UDP source port	Integer: Answer with the decimal value of the field.
ar	IP TTL	Integer: Answer with the decimal value of the field.
as	IP destination address	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21

Considering the following packet:

```
# 0x0000:  5d36 e412 f514 c15c 6720 effb 8100 6240   ]6.....\g.....b@
# 0x0010:  0800 4500 0079 0000 0000 1511 0000 b62b   ..E..y.........+
# 0x0020:  2c60 dd06 c56e 0968 bf3b 0021 5896 b884   ,`...n.h.;.!X...
# 0x0030:  10a5 a8a2 b1ae 08ec a9b4 b0e1 2b5a 10d9   ............+Z..
# 0x0040:  2015 b98e 7833 39f7 447f 1454 8213 dc6d   ....x39.D..T...m
# 0x0050:  f3f9 9ac5 0554 3bc8 8856 d052 3afb 2092   .....T;..V.R:...
# 0x0060:  9d86 5581 efba e3ef fc00 7815 20e3 d32e   ..U.......x.....
# 0x0070:  f445 8a3c cce5 f836 1cd5 31a7 5e9a 3d1c   .E.<...6..1.^.=.
# 0x0080:  979b 9eff bde2 77e7 e095 41               ......w...A
```

Find the value of the following fields:

Question ID	Field	Type
at	IP TTL	Integer: Answer with the decimal value of the field.
au	IP length	Integer: Answer with the decimal value of the field.
av	ETH destination address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
aw	UDP source port	Integer: Answer with the decimal value of the field.
ax	ETH frame type	Four-digit Hex: Answer with the four digit hexadecimal value of the field, e.g., 02AF. Do not put a leading 0x or $ on the front of the hexadecimal number.
ay	IP Protocol of payload	Integer: Answer with the decimal value of the field.

```
# 0x0000:   f76c 4691 19bd 98a3 6c06 4d42 8847 0000   .lF.....l.MB.G..
# 0x0010:   3f80 4500 006e 0000 4000 3506 0000 1bde   ?.E..n..@.5.....
# 0x0020:   56df bb28 845a ea89 a8d9 3e39 b03e 5c08   V..(.Z....>9.>\.
# 0x0030:   0784 5090 a0b5 0000 0000 99ae 972d 07ad   ..P..........-..
# 0x0040:   e2d1 a2ea 4521 6ff8 c4da 7f48 fc27 ce4b   ....E!o....H.'.K
# 0x0050:   d03f ac99 a8bb b704 606c a7e9 4a36 0bf8   .?......`l..J6..
# 0x0060:   8c81 7b4c 5d95 797c de58 79b1 568f 9f37   ..{L].y|.Xy.V..7
# 0x0070:   96f0 e2a4 5b4b 5d76 2170 de52 aa8a 7d3f   ....[K]v!p.R..}?
```

Find the value of the following fields:

Question ID	Field	Type
az	TCP CWR	Boolean: Answer Y or N
ba	TCP source port	Integer: Answer with the decimal value of the field.
bb	TCP RST	Boolean: Answer Y or N
bc	ETH source address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
bd	Frame is 802.1q	Boolean: Answer Y or N
be	MPLS TTL	Integer: Answer with the decimal value of the field.

Considering the following packet:

```
# 0x0000:  82c2 0018 7f77 7cab 5d33 2db9 88a8 6654   .....w|.]3-...fT
# 0x0010:  0800 4500 008a 0000 4000 1806 0000 b221   ..E.....@......!
# 0x0020:  2eed 153a c944 15d2 4a3d 5ae1 bc37 5691   ...:.D..J=Z..7V.
# 0x0030:  fffd 50b7 8a58 0000 0007 e0ca e6d2 9b69   ..P..X.........i
# 0x0040:  33ec d2af 64b8 7503 96a2 e63c b1dd 005c   3...d.u....<...\
# 0x0050:  000d 3b75 cb6a ef13 3b0e 2f7d 9fae 9783   ..;u.j..;./}....
# 0x0060:  881a 3a61 21d3 1d5a f109 3c55 dcf2 218b   ..:a!..Z..<U..!.
# 0x0070:  42d1 86b8 2fe0 e4be 6f80 e61b 267c 4927   B.../...o...&|I'
# 0x0080:  f967 44c7 e214 1e9b 2c49 3451 b050 048a   .gD.....,I4Q.P..
# 0x0090:  a2a6 d471 7163 d854 5a69 d2fe             ...qqc.TZi..
```

Find the value of the following fields:

Question ID	Field	Type
bf	TCP ACK sequence number	Integer: Answer with the decimal value of the field.
bg	TCP source port	Integer: Answer with the decimal value of the field.
bh	IP FLAGS	Integer: Answer with the decimal value of the field.
bi	IP length	Integer: Answer with the decimal value of the field.
bj	Frame is 802.1q	Boolean: Answer Y or N
bk	IP ToS	Integer: Answer with the decimal value of the field.

Considering the following packet:

```
# 0x0000:  bb1f b09c fd6f 9910 5bf1 55c9 0806 0001   .....o..[.U.....
# 0x0010:  0800 0604 0001 7ec9 a0b4 40f6 492f 1c28   ......~...@.I/.(
# 0x0020:  11f0 b735 7395 0b83 e3c4 8ee3 594d 485b   ...5s.......YMH[
# 0x0030:  b99c f565 efa4 58a1 f56d 3236 be95 bcea   ...e..X..m26....
# 0x0040:  e7fd f719 7190 1a7b 2441 9bfe 94ab 66      ....q..{$A....f
```

Find the value of the following fields:

Question ID	Field	Type
b1	ARP HTYPE	Integer: Answer with the decimal value of the field.
bm	ARP request	Boolean: Answer Y or N
bn	ARP target IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
bo	ETH destination address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
bp	ARP source IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
bq	ETH frame type	Four-digit Hex: Answer with the four digit hexadecimal value of the field, e.g., 02AF. Do not put a leading 0x or $ on the front of the hexadecimal number.

Considering the following packet:

```
# 0x0000:   d1c5 22c0 6c77 90e5 32b6 6133 88a8 5520   ..".lw..2.a3..U.
# 0x0010:   0806 0001 0800 0604 0001 b464 f03d 2b1d   ...........d.=+.
# 0x0020:   2f4c 9168 5e3f 0a7c c4e6 af59 1243 8891   /L.h^?.|...Y.C..
# 0x0030:   5f86 819e 2da8 5b93 3f40 93fe 977f 8458   _...-.[.?@.....X
# 0x0040:   4a45 d367 971a 1ac5 c4a7 9238 2c01 10c1   JE.g.......8,...
# 0x0050:   59d9 4399 691b 0041 a914 7a3e 343f 85e3   Y.C.i..A..z>4?..
# 0x0060:   adb9 4dd2 5572 328c 7b91 286b a837 7ec0   ..M.Ur2.{.(k.7~.
# 0x0070:   7028                                      p(
```

Find the value of the following fields:

Question ID	Field	Type
br	ARP target MAC	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
bs	ETH frame type	Four-digit Hex: Answer with the four digit hexadecimal value of the field, e.g., 02AF. Do not put a leading 0x or $ on the front of the hexadecimal number.
bt	Frame is 802.1ad	Boolean: Answer Y or N
bu	ARP HTYPE	Integer: Answer with the decimal value of the field.
bv	ARP reply	Boolean: Answer Y or N
bw	ETH destination address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00

Considering the following packet:

```
# 0x0000:   436c 09bc 7fce 188d c92a e8dd 0800 4500   Cl.......*....E.
# 0x0010:   006f 0000 4000 1106 0000 c065 a53e 2b5e   .o..@......e.>+^
# 0x0020:   5f5f 4a69 9d4b 20de 23b8 6763 df2d 5027   __Ji.K..#.gc.-P'
# 0x0030:   1835 0000 000f fd56 585f d035 9dae ef95   .5.....VX_.5....
# 0x0040:   2947 58de 653c 6893 afbd c049 a1f6 30cc   )GX.e<h....I..0.
# 0x0050:   fae5 0837 4a9e 8623 c222 4508 85a8 3d4a   ...7J..#."E...=J
# 0x0060:   e21c 76d1 8daa d366 1cc9 19d4 fc4b c4c3   ..v....f.....K..
# 0x0070:   9b6a b127 dc64 ddba 9d9d cb3a c6          .j.'.d.....:.
```

Find the value of the following fields:

Question ID	Field	Type
bx	IP ECN	Integer: Answer with the decimal value of the field.
by	TCP SYN	Boolean: Answer Y or N
bz	ETH destination address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
ca	TCP ACK sequence number	Integer: Answer with the decimal value of the field.
cb	TCP PSH	Boolean: Answer Y or N
cc	TCP source port	Integer: Answer with the decimal value of the field.

Considering the following packet:

```
# 0x0000:   beea 26a7 4842 22cf f29d cddc 8847 0001   ..&.HB"......G..
# 0x0010:   2373 4500 007c 0000 4000 3f06 0000 16c3   #sE..|..@.?.....
# 0x0020:   4e3d 2694 ac2d 38b0 f6a1 4576 d2f4 5775   N=&..-8...Ev..Wu
# 0x0030:   808e 5097 ff20 0000 0007 f6f7 609e 7ad5   ..P.........`.z.
# 0x0040:   e116 13a6 b14e 34e8 a977 18a3 ba07 0efc   .....N4..w......
# 0x0050:   641f c10a 5792 8d5b 3258 7d8b bd64 c13b   d...W..[2X}..d.;
# 0x0060:   64c5 71c9 a4bd d006 bd11 95be a3ef 3b5a   d.q...........;Z
# 0x0070:   c72e 7cfc 6035 dea7 9b18 ca81 00fc ca9b   ..|.`5..........
# 0x0080:   21b4 f99e ffbf 71ff 6ea5 8349 280c       !.....q.n..I(.
```

Find the value of the following fields:

Question ID	Field	Type
cd	ETH destination address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
ce	TCP CWR	Boolean: Answer Y or N
cf	Frame is 802.1ad	Boolean: Answer Y or N
cg	IP source address	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
ch	TCP PSH	Boolean: Answer Y or N
ci	IP TTL	Integer: Answer with the decimal value of the field.

Considering the following packet:

```
# 0x0000:  0f3a effb aa57 e157 13b5 2305 8847 0000   .:...W.W..#..G..
# 0x0010:  ad34 4500 0052 0000 0000 0d11 0000 08a4   .4E..R..........
# 0x0020:  10b7 275b 6695 1971 e1c6 00e1 27d7 49c1   ..'[f..q....'.I.
# 0x0030:  3923 0442 0ceb 39dd fd9d 873d 2a00 b319   9#.B..9....=*...
# 0x0040:  58bc 38de 8c73 6f09 27c6 a647 0b26 bdf7   X.8..so.'..G.&..
# 0x0050:  1719 082f ee9c 56bf 7386 8a11 a8f7 e17a   .../..V.s......z
# 0x0060:  2fc4 6f83                                 /.o.
```

Find the value of the following fields:

Question ID	Field	Type
cj	Frame is 802.1q	Boolean: Answer Y or N
ck	ETH source address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
cl	IP TTL	Integer: Answer with the decimal value of the field.
cm	IP length	Integer: Answer with the decimal value of the field.
cn	IP FLAGS	Integer: Answer with the decimal value of the field.
co	IP source address	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21

Considering the following packet and the requested fields:

Question ID	Field	Answer
cp	IP FLAGS	0
cq	Frame is 802.1ad	N
cr	IP TTL	4
cs	TCP URG	Y
ct	IP ECN	0
cu	ETH destination address	99:3a:a8:99:4c:ae

Considering the following packet:

```
# 0x0000:   1fe4 6f5f 1d40 0925 246b c224 0806 0001   ..o_.@.%$k.$....
# 0x0010:   0800 0604 0002 a7de 88c4 4c8b 59f4 9498   ..........L.Y...
# 0x0020:   2002 71f1 f1b1 5b9a c0d5 eaa8 79e3 2f56   ..q...[.....y./V
# 0x0030:   14a8 de3c 7211 0552 4bb3 4f3b 81b6 1e1f   ...<r..RK.O;....
# 0x0040:   5cb6 a192 58a9 f944 f507 7923 cf87 78d8   \...X..D..y#..x.
# 0x0050:   36cc 371f c652 0310 3299 1d61 5a67 7eca   6.7..R..2..aZg~.
# 0x0060:   5ef7 9813 b4f2 cbd2 37f2 abf7 50ab a117   ^.......7...P...
# 0x0070:   06e5 1cb6 206a f3d0 3fb5 e390 0987 314b   .....j..?.....1K
# 0x0080:   43a6 48e2 bbd9                            C.H...
```

Find the value of the following fields:

Question ID	Field	Type
cv	ARP HTYPE	Integer: Answer with the decimal value of the field.
cw	ARP PTYPE	Integer: Answer with the decimal value of the field.
cx	ARP target IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
cy	ETH destination address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
cz	ARP target MAC	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
da	Frame is 802.1ad	Boolean: Answer Y or N

db — IP source address: 176.190.168.196

dc — ETH destination address: c7:e3:af:ff:9a:f7

dd — TCP CWR: Y

de — Frame is MPLS: N

df — IP destination address: 187.208.42.219

dg — IP length: 75

Considering the following packet:

```
# 0x0000:  a7de 720f c46c a03e cc35 d0e4 0800 4500  ..r..l.>.5....E.

# 0x0010:  005f 0000 4000 1106 0000 9b6a 86ff c11f  ._..@......j....

# 0x0020:  b25a f21b c7ef 51a4 d846 42ae 9e85 5094  .Z....Q..FB...P.

# 0x0030:  793a 0000 0008 952f 3406 e7b5 927a 45e5  y:...../4....zE.

# 0x0040:  4ef6 461d 28a9 d0d0 a4c3 97fe 6ac4 3c23  N.F.(.......j.<#

# 0x0050:  9e98 20b8 f38e 487e 746c 70ad 2c4e 9e31  ......H~tlp.,N.1

# 0x0060:  ce9d 4c58 050d 39a6 59d2 c247 26          ..LX..9.Y..G&
```

Find the value of the following fields:

Question ID	Field	Type
dh	IP Protocol of payload	Integer: Answer with the decimal value of the field.
di	IP Don't Frag	Boolean: Answer Y or N
dj	Frame is MPLS	Boolean: Answer Y or N
dk	IP length	Integer: Answer with the decimal value of the field.
dl	TCP window size	Integer: Answer with the decimal value of the field.
dm	Frame is 802.1ad	Boolean: Answer Y or N

2 Lecture Material Comprehension

The following questions are designed with two purposes in mind:

1. To help you engage with the lecture materials; and

2. To help generate a wide range of questions for the quizzes in this topic.

The second goal is not mandatory for you. However, if you are willing for the answers you provide to the questions in this section to be used in future quizzes in this topic, you are requested to answer the following question as follows *you will not be penalised if you do not give this permission*

Question#	Description
dn	Are you willing to release your following answers in this section from all copyrights, i.e., release them into the public domain, including so that they can be included in quizzes in this topic? *you will not be penalised or treated any differently if you do not choose to give this permission*

It is important that you answer this question with 'y', if you do decide that you would like to do this (but again, you have no obligation to do so, and you will not be treated differently whether or not you give permission).

The entry in `unit5-answers.txt` would thus look like:

```
# Question 'dn': Do you commit the following answers to the public domain
#  and disclaim all copyrights in them?
dn=y
```

For each question, you must record your answer in the unit5-answers.txt file in your git repository. For each question, you are required to write a statement that is either true or false about the material in the indicated lecture slide.

*For example, if you were asked 'write a **true** statement about the content of Slide 2 of Chapter 1', you would put the statement at the end of the* `rj=` *line in the file* `unit5-answers.txt`. *For example, if your statement was 'One of the problems addressed in this chapter is how to build scalable networks', you would write:*

Question#	Description
pz	*Write a **true** statement about the content of Slide 2 of Chapter 1*

The entry in `unit5-answers.txt` *would thus look like:*

```
# Question 'pz': Write a true statement about the content of Slide 2 of Chapter 1

pz=One of the problems addressed in this chapter is how to build scalable networks
```

Templates for each answer are provided in `unit5-answers.txt` for your convenience.

If you are asked to write a statement that is false, i.e., untrue, think about statements that someone who has not worked through the material might think would be true. Be creative! Be devious!

Question#	Description
do	Write a **true** statement about the content of Slide 6 of Chapter 7
dp	Write a **true** statement about the content of Slide 3 of Chapter 3
dq	Write a **true** statement about the content of Slide 15 of Chapter 1
dr	Write a **false** statement about the content of Slide 18 of Chapter 3
ds	Write a **false** statement about the content of Slide 46 of Chapter 2
dt	Write a **true** statement about the content of Slide 105 of Chapter 6
du	Write a **true** statement about the content of Slide 27 of Chapter 1
dv	Write a **true** statement about the content of Slide 88 of Chapter 3
dw	Write a **false** statement about the content of Slide 51 of Chapter 9
dx	Write a **true** statement about the content of Slide 7 of Chapter 6