# Computer Networks 2021 Exercises - Unit 5

# FAN: hang0013

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:

- $\bullet \ https://en.wikipedia.org/wiki/Ethernet\_frame\#Header$
- https://en.wikipedia.org/wiki/IPv4#Header
- $\bullet \ \ https://en.wikipedia.org/wiki/Address\_Resolution\_Protocol$
- https://en.wikipedia.org/wiki/Transmission\_Control\_Protocol#TCP\_segment\_structure
- https://en.wikipedia.org/wiki/User\_Datagram\_Protocol#UDP\_datagram\_structure

Question	Field	Туре
ID		
ab	IP DSCP	Integer: Answer with the decimal value of the field.
ac	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.
ad	IP length	Integer: Answer with the decimal value of the field.
ae	ETH destina- tion address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
af	IP Don't Frag	Boolean: Answer Y or N
ag	ETH source ad- dress	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00

Question	Field	Туре
ID		
ah	TCP CWR	Boolean: Answer Y or N
ai	TCP sequence	Integer: Answer with the decimal value of the field.
aj	IP ToS	Integer: Answer with the decimal value of the field.
ak	IP FLAGS	Integer: Answer with the decimal value of the field.
al	IP Don't Frag	Boolean: Answer Y or N
am	IP source ad- dress	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21

```
# 0x0000: 786a 2975 24c5 d38d f586 2f5f 0806 0001 xj)u$...../_....

# 0x0010: 0800 0604 0001 4824 4299 5284 8b73 685f .....H$B.R..sh_

# 0x0020: 5849 d928 beb3 29c5 679f d649 a79c 06dc XI.(..).g..I....

# 0x0030: 4372 5f34 a4d0 4f25 5f89 4bc4 511e d5da Cr_4..0%_.K.Q...

# 0x0040: dd4f a69f 02d9 3524 0339 43cb 5994 7c0f .0...5$.9C.Y.|.

# 0x0050: ce ...
```

Question	Field	Туре
	TIGIU	1,700
ID		
an	ARP source	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
ao	ARP target MAC	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
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	ARP PTYPE	Integer: Answer with the decimal value of the field.
ar	ETH destina- tion address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
as	ETH source ad- dress	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00

# 0x0000: 0954 ac41 d021 6de7 8dd1 b84b 0806 0001 .T.A.!m....K....

# 0x0010: 0800 0604 0002 9523 6d5f 248f 70fd 0f17 .....#m\_\$.p...

# 0x0020: ee17 b7fc fa46 2794 aaf0 4115 3447 3779 .....F'...A.4G7y

# 0x0030: cb49 7086 4103 fb91 5e38 a7df 8d83 490b .Ip.A...^8....I.

# 0x0040: b1a8 8860 a738 0809 96fa debb 7cee 0844 ...`.8.....|..D

# 0x0050: 076d .m

Question	Field	Туре
ID		
at	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.
au	Frame is	Boolean: Answer Y or N
av	ARP target IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
aw	ETH destina- tion address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
ax	ARP source IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
ay	Frame is 802.1q	Boolean: Answer Y or N

# 0x0000: 99cc b24b 63c9 eb99 26fc 1edb 0800 4500 ...Kc...&....E.

# 0x0010: 0043 0000 4000 3506 0000 5acb f565 d378 .C..@.5...Z..e.x

# 0x0020: 5c55 fa76 6ed9 1e15 7b95 1c3e eb70 5016 \U.vn...{..>.pP.

# 0x0030: 5fce 0000 0007 14c5 fc32 25bc 31ff 2bdd \_.....2%.1.+.

# 0x0040: 5e36 bfde 4353 279f 692e e94e 0e98 bec9 ^6..CS'.i..N....

# 0x0050: 10 .

Question	Field	Туре
ID		
az	TCP PSH	Boolean: Answer Y or N
ba	TCP ACK	Boolean: Answer Y or N
bb	IP destination	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
bc	Frame is	Boolean: Answer Y or N
bd	TCP SYN	Boolean: Answer Y or N
be	TCP window	Integer: Answer with the decimal value of the field.

# 0x0000: b6fd e390 f964 ab62 943e 9194 8848 0000 ....d.b.>...H...

# 0x0010: 3d03 4500 0083 0000 4000 2e11 0000 7916 =.E....@....y.

# 0x0020: 3eeb 019a e3f5 f35e 385a 0032 6788 9c05 >......^8Z.2g...

# 0x0030: 67e7 3b44 953d 0cf5 153e 6a37 4af0 0cda g.;D.=...>j7J...

# 0x0040: 53a8 8a45 ec8e af82 524d 3749 78b5 c923 S..E...RM7Ix..#

# 0x0050: 52fe 37a0 28ce 8add f47a 2b70 9d64 4f0d R.7.(...z+p.d0.

# 0x0060: bcfc 966a 3b61 4b09 d582 8054 63cb ecb1 ...j;aK....Tc...

# 0x0070: d569 164b da10 b283 dcc7 2190 a853 7752 .i.K....!.SwR

# 0x0080: c135 1e32 8cc9 8981 1fb4 68b1 f682 9b8a .5.2....h....

# 0x0090: 8f05 9856 34 ...V4

Question	Field	Туре
ID		
bf	UDP destination	Integer: Answer with the decimal value of the field.
bg	IP TTL	Integer: Answer with the decimal value of the field.
bh	IP ECN	Integer: Answer with the decimal value of the field.
bi	MPLS last la- bel?	Boolean: Answer Y or N
bj	IP length	Integer: Answer with the decimal value of the field.
bk	MPLS TTL	Integer: Answer with the decimal value of the field.

```
# 0x0000: a255 4025 def9 d02d e93b c5c4 8848 0000 .U0%...-.;...H..
```

# 0x0010: 15aa 4500 0039 0000 0000 3111 0000 9fd3 ..E..9....1.....

# 0x0020: 9724 a0e6 a267 52d0 8afb 010f ccfd a612 .\$...gR......

# 0x0030: f69e e797 8127 6c06 990e 763f af58 69a5 .....'l...v?.Xi.

# 0x0040: 7f00 96f1 dcb3 426d 6bfa 35 .....Bmk.5

Question	Field	Туре
ID		
bl	IP TTL	Integer: Answer with the decimal value of the field.
bm	IP Protocol of payload	Integer: Answer with the decimal value of the field.
bn	IP length	Integer: Answer with the decimal value of the field.
bo	UDP source port	Integer: Answer with the decimal value of the field.
bp	IP DSCP	Integer: Answer with the decimal value of the field.
bq	IP More Frag- ments	Boolean: Answer Y or N

```
# 0x0000: 370f 512f aaf5 ae29 672a 19c3 0800 4500 7.Q/...)g*....E.

# 0x0010: 0070 0000 4000 2d11 0000 675c 7bdb e919 .p..@.-...g\{...

# 0x0020: 9ec3 005e ffd9 00b5 7107 913e 72b5 6179 ....^...q..>r.ay

# 0x0030: 5e7c 7976 8813 0afd 6fe1 62fb 9b80 442a ^|yv...o.b...D*

# 0x0040: a5f7 1759 0d71 3cbc 72dc dcf8 57e5 00e8 ...Y.q<.r...W...

# 0x0050: f466 6c8a a329 9b74 46e2 b771 db4d 134c .fl..).tF..q.M.L

# 0x0060: eaa6 1c50 ff60 e079 85f7 f86f f199 7c69 ...P.`.y...o..|i

# 0x0070: c343 ef2f e2b8 bcd5 076a 5e8f 636d .C./....j^.cm
```

Question	Field	Туре
ID		
br	Frame is 802.1q	Boolean: Answer Y or N
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	IP source ad- dress	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
bu	IP ECN	Integer: Answer with the decimal value of the field.
bv	IP TTL	Integer: Answer with the decimal value of the field.
bw	ETH destina- tion address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00

```
# 0x0000: a562 5fcb 6cc7 6d31 943b 8db0 8100 63f1 .b_.l.m1.;....c.

# 0x0010: 0806 0001 0800 0604 0002 71e9 8be9 b421 .....q....!

# 0x0020: 8313 4c9d e13d 5a52 e43f 613c 09bf 45b5 ..L.=ZR.?a<..E.

# 0x0030: c1ca bf81 0f06 2d33 2614 a3eb 0058 0f6b .....-3&....X.k

# 0x0040: 2b48 ea03 d3fe fe60 36ef 8be7 b77a f640 +H.....6...z.@

# 0x0050: bbb8 53dc e019 8f3a 134b dc95 2dc7 8027 ..S...:.K..-..'

# 0x0060: 74ec 0573 c80e d54f 3810 f077 bf3e ecdf t..s...08..w.>..

# 0x0070: d83a 4ca6 0644 5e7e 1d14 1506 5394 2201 .:L..D~...S.".
```

Question	Field	Туре
ID		
bx	ARP source IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
by	ARP PTYPE	Integer: Answer with the decimal value of the field.
bz	ARP target IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
ca	ARP source	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
cb	Frame is 802.1ad	Boolean: Answer Y or N
СС	Frame is MPLS	Boolean: Answer Y or N

```
# 0x0000: d371 4f2b c75f 8fb6 a5a6 4c24 0806 0001 .q0+._...L$....

# 0x0010: 0800 0604 0001 86dc b465 b2ab 62ac d810 .....e..b...

# 0x0020: 8c07 bf51 0206 61a9 32db a3a2 05ea 4701 ...Q..a.2.....G.

# 0x0030: 76a1 438e 9dc5 61b0 5094 650d 0851 0908 v.C...a.P.e..Q..

# 0x0040: f107 e4c2 c90d 2848 b9b9 5b04 73a6 bee8 .....(H..[.s...

# 0x0050: 047e 2ded 75cd 4b43 8c14 0400 6002 242e .~-.u.KC....`.$.

# 0x0060: 3ed6 9a81 546f edb5 45b5 458b a140 bb17 >...To..E.E..@..

# 0x0070: 095f a232 41 .__.2A
```

Question	Field	Туре
ID		
cd	Frame is 802.1q	Boolean: Answer Y or N
се	ARP target MAC	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
cf	ETH source ad- dress	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
cg	ETH destina- tion address	Ethernet MAC Address. Answer in the customary format, retaining leading zeroes, e.g., 02:ca:fe:f0:0d:00
ch	ARP source IP	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21
ci	ARP reply	Boolean: Answer Y or N

```
# 0x0000: 3a23 ba0e 5f63 bf59 8f38 9d95 88a8 601c :#.._c.Y.8....`.

# 0x0010: 0800 4500 0067 0000 4000 3911 0000 7569 ..E..g..@.9...ui

# 0x0020: ff4f 8f36 35b7 35d8 b17e 00cc 86ca 46d8 .0.65.5..~...F.

# 0x0030: ce05 5b56 62e5 01c1 e8c9 dd26 b1f7 a401 ..[Vb.....&....

# 0x0040: bca0 f79d a792 9a4f bc36 ac7a f741 7d78 .....0.6.z.A}x

# 0x0050: a276 54a1 fc38 e4c2 18e6 82b0 3b04 0a1f .vT..8.....;...

# 0x0060: f965 0358 d564 a342 3f6a fc7e 9f07 2401 .e.X.d.B?j.~..$.

# 0x0070: 791c bd3a 20fe 4068 ab y.....@h.
```

Question	Field	Туре
ID		
cj	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.
ck	IP Protocol of payload	Integer: Answer with the decimal value of the field.
cl	Frame is 802.1q	Boolean: Answer Y or N
cm	IP ToS	Integer: Answer with the decimal value of the field.
cn	UDP source port	Integer: Answer with the decimal value of the field.
со	IP More Frag- ments	Boolean: Answer Y or N

```
# 0x0000: ca01 d963 d576 15f2 e094 5a51 88a8 3a24 ...c.v...ZQ..:$
# 0x0010: 0800 4500 008d 0000 4000 3106 0000 0435 ..E....@.1....5
# 0x0020: f565 f67c d03f 8924 a1f4 1a5c d0d6 1412 .e.|.?.$...\...
# 0x0030: 052a 50b5 e7b8 0000 000b 7061 9229 058d .*P.....pa.)..
# 0x0040: 6faf 27db 66ae bf7b 4524 dd3d 36bd d641 o.'.f..{E$.=6..A}
# 0x0050: e6e8 6ba5 0b93 10e6 4147 5c05 b956 6694 ..k....AG\..Vf.
# 0x0060: 4878 1ceb 699b 9e08 ed20 67f5 d7ed d540 Hx..i....g...@
# 0x0070: ddd8 9524 51c9 8a3c 8d06 9e25 0dee 785d ...$Q..<...%.x]
# 0x0080: 0f80 4d60 ae7e a1f8 4979 2096 10fd abb9 ..M`.~..Iy.....
```

Question	Field	Туре
ID		
ср	Frame is	Boolean: Answer Y or N
cq	IP Don't Frag	Boolean: Answer Y or N
cr	IP DSCP	Integer: Answer with the decimal value of the field.
cs	TCP FIN	Boolean: Answer Y or N
ct	TCP sequence	Integer: Answer with the decimal value of the field.
cu	TCP ACK	Boolean: Answer Y or N

```
# 0x0000: c1dd 1c70 46f6 266e 4acb a27f 8847 0000 ...pF.&nJ....G..

# 0x0010: 61e8 4500 0041 0000 4000 2b06 0000 cffc a.E..A..@.+....

# 0x0020: 869d 3238 f314 64ef dd38 2cb9 4512 09b3 ...28..d..8,.E...

# 0x0030: 9e66 50b3 d880 0000 000f 73e6 87f7 55a4 .fP.....s...U.

# 0x0040: 43ee 2eb4 8fe4 373e 0bbf 30b4 9c35 07e2 C.....7>..0..5..

# 0x0050: 9e5b d4 ...[.
```

Question	Field	Туре
ID		
cv	TCP ACK	Boolean: Answer Y or N
CW	TCP sequence	Integer: Answer with the decimal value of the field.
сх	TCP window	Integer: Answer with the decimal value of the field.
су	Frame is 802.1q	Boolean: Answer Y or N
CZ	TCP RST	Boolean: Answer Y or N
da	IP TTL	Integer: Answer with the decimal value of the field.

# 0x0000: 521e d156 6791 04b6 8ba6 c9f7 8847 0000 R..Vg.......G..

# 0x0010: cfc4 4500 0046 0000 0000 3f06 0000 d2c2 ..E..F....?.....

# 0x0020: 25dd 738f deff da83 5c9d 2de8 5f05 0b93 %.s....\.-.\_...

# 0x0030: 7b79 501d 2f47 0000 0007 5871 4a1d 2fe0 {yP./G....XqJ./.

# 0x0040: 4673 e931 57f6 57f7 7c1d a802 1362 8c91 Fs.1W.W.|....b..

# 0x0050: 26da 1bb2 cb7a 1087 &....z..

Question	Field	Туре
ID		
db	MPLS TTL	Integer: Answer with the decimal value of the field.
dc	TCP URG	Boolean: Answer Y or N
dd	TCP source port	Integer: Answer with the decimal value of the field.
de	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.
df	TCP ACK se-	Integer: Answer with the decimal value of the field.
dg	TCP ACK	Boolean: Answer Y or N

```
# 0x0000: 6fcb 4515 f54f d7ba 7934 70d5 0800 4500 o.E..O..y4p...E.
```

# 0x0010: 0037 0000 0000 1211 0000 d635 bc48 5be0 .7......5.H[.

# 0x0020: 88fd daf9 48ef 001a 1497 63a3 0d20 44c4 ....H.....c...D.

# 0x0030: 4181 3c93 5ea2 0fd7 874b 85ff cdf1 2b7a A.<.^....K....+z

# 0x0040: de21 370b 8c .!7..

### Find the value of the following fields:

Question	Field	Туре
ID		
dh	IP Don't Frag	Boolean: Answer Y or N
di	UDP destination	Integer: Answer with the decimal value of the field.
dj	Frame is	Boolean: Answer Y or N
dk	IP TTL	Integer: Answer with the decimal value of the field.
dl	IP More Frag- ments	Boolean: Answer Y or N
dm	IP source ad- dress	IPv4 address. Answer in dotted quad notation, e.g., 129.96.1.21

# 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 <b>true</b> 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 false statement about the content of Slide 85
	of Chapter 2
dp	Write a true statement about the content of Slide 69
	of Chapter 8
dq	Write a false statement about the content of Slide 45
	of Chapter 1
dr	Write a false statement about the content of Slide 32
	of Chapter 1
ds	Write a false statement about the content of Slide 22
	of Chapter 6
dt	Write a false statement about the content of Slide 38
	of Chapter 7
du	Write a true statement about the content of Slide 61
	of Chapter 9
dv	Write a <b>true</b> statement about the content of Slide 58
	of Chapter 3
dw	Write a false statement about the content of Slide 30
	of Chapter 2
dx	Write a true statement about the content of Slide 111
	of Chapter 6