

CMPE 206-01 Computer Network Design Spring 2020

HW#4 Solutions

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1.1:

Convert C2 2F 15 82 to the dotted decimals $C2=16*12+2=194$, $2F=2*16+15=47$,
 $15=1*16+5=21$, $82=16*8+2=130$, so the answer is 194.47.21.130

1.2:

Convert all the number to bit: $130=8*16+2 \rightarrow 82$, $65=4*16+1 \rightarrow 41$, $218=13*16+10 \rightarrow DA$,
 $11=0*16+11 \rightarrow 0B$. So the answer is 82.41.DA.0B.

1.3:

Since $255=1111\ 1111$, $240=1111\ 0000$, so the subnet mask 255.255.240.0

Have the $4+8=12$ digit bits that could be assigned to hosts. But we should subtract 2 Ip address for broadcasting and network address so the answer is $2^{12}-2=4094$.

1.4:

Since the subnet mask is 255.255.240.0 which is equal to
 $11111111.11111111.11110000.00000000$, so the prefix is 20

Problem 2

Address/mask	Next Hop	Represent with bits
192.21.56.0/22	Interface 1	192.21.001110 xx .xxxxxxxx
192.21.60.0/22	Interface 2	192.21.001111 xx .xxxxxxxx
135.53.40.0/23	Interface 0	135.53.0010100 x .xxxxxxxx
default	Router 1	

- a. 192.21.63.10 \rightarrow 192.21.001111 11, so it will go to **Interface2**
- b. 192.21.57.14 \rightarrow 192.21. 001110 01, so it will go to **Interface1**
- c. 192.21.52.2 \rightarrow 192.21.00 110100 , this doesn't match any of the address above, so it will go to **Router1**
- d. 135.53.40.7 \rightarrow 135.53.0010100 0, so it will go to **Interface0**
- e. 135.53.46.7 \rightarrow 135.53.0011100 0, so it will go to **Router1**

Problem 3:

1. www.berkeley.edu

```
HaoRans-MacBook-Pro:~ haoranchen$ traceroute www.berkeley.edu
traceroute: Warning: www.berkeley.edu has multiple addresses; using 52.35.220.253
traceroute to www-production-1113102805.us-west-2.elb.amazonaws.com (52.35.220.253), 64 hops
max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 4.166 ms 4.007 ms 4.265 ms
 2 96.120.94.9 (96.120.94.9) 17.264 ms 23.768 ms 16.184 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 22.829 ms 18.145 ms 17.42
 8 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 15.744 ms 29.557 ms 40.3
34 ms
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 16.814 ms 32.949 ms 19.468
ms
 6 be-11083-pe02.529bryant.ca.ibone.comcast.net (68.86.84.14) 19.370 ms 16.610 ms 18.514
ms
 7 as16509-2-c.529bryant.ca.ibone.comcast.net (66.208.229.30) 39.107 ms 34.649 ms 22.956
ms
 8 * * *
 9 * * *
10 * * *
```

- 2. www.mit.edu

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```
HaoRans-MacBook-Pro:~ haoranchen$ traceroute www.mit.edu
traceroute to e9566.dsdb.akamaiedge.net (23.38.224.128), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 5.875 ms 5.359 ms 7.480 ms
 2 96.120.94.9 (96.120.94.9) 138.026 ms 82.788 ms 155.357 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 26.495 ms 153.824 ms 146.981 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 25.114 ms 18.952 ms 137.413 ms
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 16.976 ms 163.767 ms 16.357 ms
 6 be-11025-cr01.9greateoaks.ca.ibone.comcast.net (68.86.87.158) 23.863 ms 18.588 ms 17.604 ms
 7 be-12544-pe01.9greateoaks.ca.ibone.comcast.net (68.86.87.150) 144.225 ms 18.505 ms 144.968 ms
 8 50.242.150.142 (50.242.150.142) 147.374 ms 34.159 ms 20.473 ms
 9 ae6.qts-sjc.netarch.akamai.com (23.203.158.130) 32.154 ms 18.586 ms 17.801 ms
10 * * *
```

- 3. www.vu.nl

```
traceroute: Warning: www.vu.nl has multiple addresses; using 104.22.8.60
traceroute to www.vu.nl.cdn.cloudflare.net (104.22.8.60), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 2.877 ms 2.588 ms 2.133 ms
 2 96.120.94.9 (96.120.94.9) 16.667 ms 458.612 ms 17.380 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 20.788 ms 16.932 ms 17.815 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 15.278 ms 16.078 ms 27.586 m
;
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 15.564 ms 21.776 ms 24.247 ms
 6 be-21025-cr01.9greateoaks.ca.ibone.comcast.net (68.86.84.250) 23.177 ms 18.639 ms 17.998 m
;
 7 be-12578-pe04.9greateoaks.ca.ibone.comcast.net (68.86.88.18) 18.032 ms 24.361 ms 33.125 ms
 8 66.208.228.6 (66.208.228.6) 54.855 ms 31.831 ms 37.081 ms
 9 104.22.8.60 (104.22.8.60) 13.681 ms 28.781 ms 26.864 ms
HaoRans-MacBook-Pro:~ haoranchen$
```

- 4. www.ucl.ac.uk

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tracert to wwwr-02-188.gtm.ucl.ac.uk (144.82.250.24), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 2.424 ms 3.667 ms 3.270 ms
 2 96.120.94.9 (96.120.94.9) 30.431 ms 18.112 ms 17.361 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 14.971 ms 26.006 ms 14.025 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 12.499 ms 16.153 ms 16.056 ms
 5 be-299-ar01.santaclara.ca.sfba.comcast.net (68.86.143.93) 14.672 ms 36.272 ms 18.799 ms
 6 * *

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- 5. www.usyd.edu.au

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tracert to rp0.ucc.usyd.edu.au (129.78.5.11), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 6.026 ms 6.883 ms 3.036 ms
 2 96.120.94.9 (96.120.94.9) 13.707 ms 19.548 ms 14.084 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 14.864 ms 14.097 ms 12.663 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 15.027 ms 21.335 ms 17.332 ms
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 27.431 ms 18.662 ms 24.696 ms
 6 be-11025-cr01.9greateaks.ca.ibone.comcast.net (68.86.87.158) 16.009 ms 20.245 ms 13.899 ms
 7 be-12578-pe04.9greateaks.ca.ibone.comcast.net (68.86.88.18) 30.095 ms 16.825 ms 23.215 ms
 8 ae-13.a02.snjsca04.us.bb.gin.ntt.net (129.250.66.33) 28.345 ms 22.131 ms 13.986 ms
 9 ae-4.r02.snjsca04.us.bb.gin.ntt.net (129.250.3.102) 24.490 ms 16.251 ms 14.901 ms
10 ae-4.r06.plalca01.us.bb.gin.ntt.net (129.250.4.118) 17.075 ms 31.605 ms 25.391 ms
11 xe-0-1-0-0-4.r06.plalca01.us.ce.gin.ntt.net (140.174.28.138) 22.421 ms 18.891 ms 23.574 ms
12 xe-1-2-1-pe2.brwy.nsw.aarnet.net.au (202.158.194.176) 182.062 ms 177.738 ms 174.477 ms
13 et-3-1-0-pe1.brwy.nsw.aarnet.net.au (113.197.15.146) 176.763 ms 186.425 ms 179.838 ms
14 gw1.vl216.ae11.pe1.brwy-pe1.aarnet.net.au (138.44.5.47) 171.551 ms 170.666 ms 177.868 ms
15 *

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- 6. www.u-tokyo.ac.jp

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tracert to wwwr-02-188.gtm.ucl.ac.uk (144.82.250.24), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 3.332 ms 4.879 ms 4.257 ms
 2 96.120.94.9 (96.120.94.9) 16.138 ms 20.651 ms 21.234 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 14.282 ms 17.581 ms 19.525 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 18.963 ms 24.800 ms 13.664 ms
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 24.283 ms 23.266 ms 12.947 ms
 6 be-21025-cr01.9greateaks.ca.ibone.comcast.net (68.86.84.250) 56.293 ms 25.912 ms 15.985 ms
 7 be-12578-pe04.9greateaks.ca.ibone.comcast.net (68.86.88.18) 31.171 ms 20.678 ms 14.824 ms
 8 ae-13.a02.snjsca04.us.bb.gin.ntt.net (129.250.66.33) 14.919 ms 40.706 ms 19.040 ms
 9 ae-4.r02.snjsca04.us.bb.gin.ntt.net (129.250.3.102) 128.087 ms 134.319 ms 122.466 ms
10 ae-11.r22.snjsca04.us.bb.gin.ntt.net (129.250.3.120) 22.596 ms 19.229 ms 25.685 ms
11 ae-17.r24.osakjp02.jp.bb.gin.ntt.net (129.250.2.119) 120.378 ms 122.436 ms 118.442 ms
12 ae-1.r02.osakjp02.jp.bb.gin.ntt.net (129.250.2.40) 125.720 ms
   ae-1.r03.osakjp02.jp.bb.gin.ntt.net (129.250.7.31) 127.185 ms
   ae-1.r02.osakjp02.jp.bb.gin.ntt.net (129.250.2.40) 126.403 ms
13 ae-2.a01.osakjp02.jp.bb.gin.ntt.net (129.250.3.106) 120.007 ms
   ae-1.a01.osakjp02.jp.bb.gin.ntt.net (129.250.3.232) 133.892 ms
   ae-2.a01.osakjp02.jp.bb.gin.ntt.net (129.250.3.106) 127.655 ms
14 xe-0-0-22-3.a01.osakjp02.jp.ce.gin.ntt.net (61.200.80.218) 124.551 ms 128.413 ms 134.148 ms
15 158.205.192.173 (158.205.192.173) 124.806 ms 126.377 ms 123.347 ms
16 158.205.192.86 (158.205.192.86) 811.503 ms 224.439 ms 193.959 ms
17 158.205.121.38 (158.205.121.38) 145.877 ms 158.785 ms 176.732 ms
18 * * *

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- 7. www.uct.ac.za

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naorans-macbook-pro:~ naoranchen$ traceroute www.uct.ac.za
traceroute to ecm-vip-prd.uct.ac.za (137.158.154.230), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 5.491 ms 4.457 ms 6.261 ms
 2 96.120.94.9 (96.120.94.9) 27.717 ms 18.898 ms 20.474 ms
 3 be-10023-rur01.sanjose.ca.sfb.comcast.net (96.110.178.197) 24.050 ms 14.351 ms 20.994 ms
 4 be-231-rar01.santaclara.ca.sfb.comcast.net (162.151.78.249) 25.033 ms 17.720 ms 22.333 ms
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 22.678 ms 22.563 ms 65.187 ms
 6 be-21025-cr01.9greateaks.ca.ibone.comcast.net (68.86.84.250) 30.074 ms 46.890 ms 23.911 ms
 7 be-12578-pe04.9greateaks.ca.ibone.comcast.net (68.86.88.18) 20.577 ms 30.896 ms 27.358 ms
 8 ae-13.a02.snjsca04.us.bb.gin.ntt.net (129.250.66.33) 25.453 ms 19.282 ms 20.518 ms
 9 ae-4.r02.snjsca04.us.bb.gin.ntt.net (129.250.3.102) 82.641 ms
   ae-9.r01.snjsca04.us.bb.gin.ntt.net (129.250.2.2) 89.502 ms
   ae-4.r02.snjsca04.us.bb.gin.ntt.net (129.250.3.102) 89.072 ms
10 ae-1.r22.snjsca04.us.bb.gin.ntt.net (129.250.3.26) 22.263 ms 22.047 ms
   ae-11.r22.snjsca04.us.bb.gin.ntt.net (129.250.3.120) 20.537 ms
11 ae-6.r23.lsanca07.us.bb.gin.ntt.net (129.250.4.151) 26.287 ms 38.198 ms *
12 ae-1.r22.lsanca07.us.bb.gin.ntt.net (129.250.2.206) 38.926 ms 34.810 ms 27.438 ms
13 ae-3.r24.dllstx09.us.bb.gin.ntt.net (129.250.7.68) 74.952 ms 65.246 ms *
14 ae-6.r21.miamfl02.us.bb.gin.ntt.net (129.250.2.218) 1537.715 ms 168.246 ms 94.435 ms
15 ae-11.r04.miamfl02.us.bb.gin.ntt.net (129.250.4.21) 83.896 ms
   ae-9.r05.miamfl02.us.bb.gin.ntt.net (129.250.4.89) 85.188 ms
   ae-11.r04.miamfl02.us.bb.gin.ntt.net (129.250.4.21) 90.128 ms
16 ae-2.a01.miamfl02.us.bb.gin.ntt.net (129.250.3.167) 109.388 ms
   ae-3.a01.miamfl02.us.bb.gin.ntt.net (129.250.3.208) 98.590 ms
   ae-2.a01.miamfl02.us.bb.gin.ntt.net (129.250.3.167) 90.490 ms
17 xe-0-0-23-2.a01.miamfl02.us.ce.gin.ntt.net (129.250.200.114) 84.888 ms 91.279 ms 90.171 ms
18 ae0-42.rt01.bb.ampath.net (190.103.184.10) 78.724 ms 101.844 ms 87.014 ms
19 187-185-103-190.ampath.net (190.103.185.187) 901.017 ms 445.110 ms 267.823 ms
20 pc6-cpt3-p1.net.tenet.ac.za (155.232.64.137) 951.722 ms 428.062 ms 399.136 ms
21 et-0-0-1-0-cpt3-p2.net.tenet.ac.za (155.232.64.61) 403.699 ms 607.434 ms 414.170 ms
22 eth50-1-cpt2-p1.net.tenet.ac.za (155.232.64.64) 403.344 ms 276.167 ms 292.365 ms
23 be1-104-cpt2-pe1.net.tenet.ac.za (155.232.64.73) 276.111 ms 405.702 ms 410.000 ms
24 155.232.27.78 (155.232.27.78) 418.017 ms 429.019 ms 407.490 ms
25

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8. www.sjsu.edu

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naorans-macbook-pro:~ naoranchen$ traceroute www.sjsu.edu
traceroute to www.sjsu.edu.akadns.net (130.65.218.11), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 2.856 ms 3.663 ms 2.072 ms
 2 96.120.94.9 (96.120.94.9) 14.998 ms 29.576 ms 20.229 ms
 3 be-10023-rur01.sanjose.ca.sfb.comcast.net (96.110.178.197) 17.434 ms 22.190 ms 21.486 ms
 4 be-231-rar01.santaclara.ca.sfb.comcast.net (162.151.78.249) 19.118 ms 21.844 ms 15.012 ms
 5 be-3651-cr02.sunnyvale.ca.ibone.comcast.net (68.86.91.73) 23.900 ms 23.062 ms 26.826 ms
 6 be-21025-cr01.9greateaks.ca.ibone.comcast.net (68.86.84.250) 19.208 ms 18.817 ms 17.992 ms
 7 be-2211-pe11.9greateaks.ca.ibone.comcast.net (96.110.32.246) 18.508 ms 18.033 ms 23.856 ms
 8 ae-3.2011.rtsw.sunn.net.internet2.edu (162.252.69.141) 20.130 ms 15.614 ms 20.638 ms
 9 198.71.47.75 (198.71.47.75) 20.449 ms 30.775 ms 29.672 ms
10 dc-sj-csu-5--svl-aggr8-100ge.cenic.net (137.164.13.115) 28.884 ms 19.150 ms 21.796 ms
11 dc-sjsu--sj-csu-5-vl-170-20ge.cenic.net (137.164.3.167) 29.107 ms 23.673 ms 39.435 ms
12 * *

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Problem 4

Step1:

1.

```
HaoRans-MacBook-Pro:~ haoranchen$ curl www.google.com
<!doctype html><html itemscope="" itemtype="http://schema.org/WebPage" lang="en"
><head><meta content="Search the world's information, including webpages, images
, videos and more. Google has many special features to help you find exactly wha
t you're looking for." name="description"><meta content="noodp" name="robots"><m
eta content="text/html; charset=UTF-8" http-equiv="Content-Type"><meta content="
/logos/doodles/2020/stay-home-save-lives-april-20-copy-6753651837108785-law.gif"
itemprop="image"><meta content="Stay Home. Save Lives : Help Stop Coronavirus"
property="twitter:title"><meta content="Stay Home. Save Lives : Help Stop Corona
virus #GoogleDoodle" property="twitter:description"><meta content="Stay Home. Sa
ve Lives : Help Stop Coronavirus #GoogleDoodle" property="og:description"><meta
content="summary_large_image" property="twitter:card"><meta content="@GoogleDood
les" property="twitter:site"><meta content="https://www.google.com/logos/doodles
```

2.

```
HaoRans-MacBook-Pro:~ haoranchen$ traceroute www.google.com
traceroute to www.google.com (172.217.0.36), 64 hops max, 52 byte packets
 1 192.168.1.1 (192.168.1.1) 9.609 ms 7.596 ms 11.960 ms
 2 96.120.94.9 (96.120.94.9) 15.974 ms 24.341 ms 17.642 ms
 3 be-10023-rur01.sanjose.ca.sfba.comcast.net (96.110.178.197) 28.426 ms 20.8
37 ms 17.223 ms
 4 be-231-rar01.santaclara.ca.sfba.comcast.net (162.151.78.249) 16.999 ms 32.
299 ms 35.953 ms
 5 be-299-ar01.santaclara.ca.sfba.comcast.net (68.86.143.93) 18.449 ms 24.910
ms 24.956 ms
 6 96.112.146.18 (96.112.146.18) 27.015 ms 33.134 ms
 96.112.146.22 (96.112.146.22) 50.956 ms
 7 * * *
 8 lga15s43-in-f36.1e100.net (172.217.0.36) 28.675 ms
 74.125.252.150 (74.125.252.150) 26.809 ms
 72.14.239.96 (72.14.239.96) 44.622 ms
HaoRans-MacBook-Pro:~ haoranchen$
```

3.

Input	Output	Options
<div> <div>Display Options</div> <div> <input checked="" type="checkbox"/> Update list of packets in real-time <input checked="" type="checkbox"/> Automatically scroll during live capture <input type="checkbox"/> Show capture information during live capture </div> </div> <div> <div>Name Resolution</div> <div> <input checked="" type="checkbox"/> Resolve MAC Addresses <input checked="" type="checkbox"/> Resolve network names <input checked="" type="checkbox"/> Resolve transport names </div> </div>		
Stop capture automatically after		

4.5.

Capturing from Wi-Fi: en0

tcp.port == 80

No.	Time	Source	Destination	Protocol	Length	Info	RSSI	Rate
143	1587527661.142438	HaoRans-MacBook-Pr...	www.google.com	TCP	78	51772 → ht...		
144	1587527661.300121	www.google.com	HaoRans-MacBook-Pr...	TCP	74	http(80) →...		
145	1587527661.300227	HaoRans-MacBook-Pr...	www.google.com	TCP	66	51772 → ht...		
146	1587527661.300908	HaoRans-MacBook-Pr...	www.google.com	HTTP	144	GET / HTTP...		
147	1587527661.451210	www.google.com	HaoRans-MacBook-Pr...	TCP	66	http(80) →...		
148	1587527661.460083	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
149	1587527661.460090	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
150	1587527661.460187	HaoRans-MacBook-Pr...	www.google.com	TCP	66	51772 → ht...		
151	1587527661.460453	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
152	1587527661.460726	HaoRans-MacBook-Pr...	www.google.com	TCP	66	51772 → ht...		
153	1587527661.461433	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
154	1587527661.466099	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
155	1587527661.466204	HaoRans-MacBook-Pr...	www.google.com	TCP	66	51772 → ht...		
156	1587527661.466290	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
157	1587527661.466447	HaoRans-MacBook-Pr...	www.google.com	TCP	66	51772 → ht...		
158	1587527661.466519	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		
159	1587527661.467044	www.google.com	HaoRans-MacBook-Pr...	TCP	1484	http(80) →...		

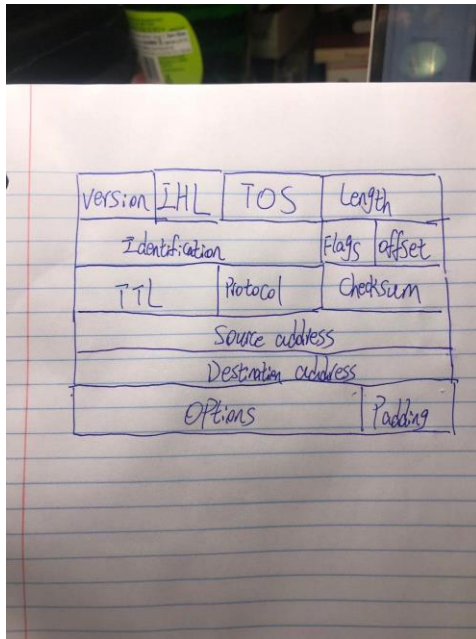
Differentiated Services Field: 0x20 (DSCP: CS1, ECN: Not-ECT)
 Total Length: 60
 Identification: 0x3686 (13958)
 Flags: 0x0000
 Fragment offset: 0
 Time to live: 122
 Protocol: TCP (6)
 Header checksum: 0xad7e [validation disabled]
 [Header checksum status: Unverified]
 Source: www.google.com (216.58.194.164)
 Destination: HaoRans-MacBook-Pro.local (192.168.1.16)

Transmission Control Protocol, Src Port: http (80), Dst Port: 51772 (51772), Seq: 0, Ack: 1, Len: 0
 Source Port: http (80)
 Destination Port: 51772 (51772)
 [Stream index: 21]

0010 00 3c 36 86 00 00 7a 06 ad 7e d8 3a c2 a4 c0 a8
 0020 01 10 00 50 ca 3c 97 e1 bf 7e 0f eb db 97 a0 12
 0030 eb 20 e0 55 00 00 02 04 05 64 04 02 08 0a 66 a3

4.2 Step 3 questions:

1. My IP Address could be seen from above picture which is 192.168.1.16, google server has a IP address as 216.58.194.164
2. yes, it includes header + payload.
3. Amazing that I found that the packets which are sent to my computer have the same Identification, however when my computer sent to google, the identification is changed from different packets by +1
4. Time to live = 64 (initial), and 64 is not the maximum number, because I see the server could send packet with 122.
5. You could check the offset field, if the packets chunk to small pieces, the offset field can't be 0, in our case the packets have all the offset field 0.
6. The length is 20, the result is calculated by four bits which is in header length field multiple 4 bytes, because the length of each row is 32 bits which is 4 bytes, so $0101(5) \times 4 = 20$ bytes. Please see the picture below.



Reference:

<https://www.pearsonitcertification.com/articles/article.aspx?p=1843887>

<https://networkengineering.stackexchange.com/questions/6855/maximum-ipv4-header-size>