

# Networking Lab 1

## Problem 7

needed subnets: 2,000

needed hosts: 15

Network Addresses: 178.100.0.0

- Address class: Class B
- Default subnet mask: 255.255.0.0
- Custom subnet mask: 255.255.255.224
- Total subnets: 2048
- Total host addresses: 32
- usable host addresses: 30
- bits borrowed: 11

Hosts

Subnets	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16384	32768	65536	131072	262144	524288	1048576	2097152	4194304	8388608	16777216	33554432	67108864	134217728	268435456	536870912	1073741824	2147483648	4294967296	8589934592	17179869184	34359738368	68719476736	137438953472	274877906944	549755813888	1099511627776	2199023255552	4398046511104	8796093022208	17592186044416	35184372088832	70368744177664	140737488355328	281474976710656	562949953421312	1125899906842624	2251799813685248	4503599627370496	9007199254740992	18014398509481984	36028797018963968	72057594037927936	144115188075855872	288230376151711744	576460752303423488	1152921504606846976	2305843009213693952	4611686018427387904	9223372036854775808	18446744073709551616	36893488147419103232	73786976294838206464	147573952589676412928	295147905179352825856	590295810358705651712	1180591620717411303424	2361183241434822606848	4722366482869645213696	9444732965739290427392	18889465931478580854784	37778931862957161709568	75557863725914323419136	151115727451828646838272	302231454903657293676544	604462909807314587353088	1208925819614629174706176	2417851639229258349412352	4835703278458516698824704	9671406556917033397649408	19342813113834066795298816	38685626227668133590597632	77371252455336267181195264	154742504910672534362390528	309485009821345068724781056	618970019642690137449562112	1237940039285380274899124224	2475880078570760549798248448	4951760157141521099596496896	9903520314283042199192993792	19807040628566084398385987584	39614081257132168796771975168	79228162514264337593543950336	158456325028528675187087900672	316912650057057350374175801344	633825300114114700748351602688	1267650600228229401496703205376	2535301200456458802993406410752	5070602400912917605986812821504	10141204801825835211973625643008	20282409603651670423947251286016	40564819207303340847894502572032	81129638414606681695789005144064	162259276829213363391578010288128	324518553658426726783156020576256	649037107316853453566312041152512	1298074214633706907132624082305024	2596148429267413814265248164610048	5192296858534827628530496329220096	10384593717069655257060992658440192	20769187434139310514121985316880384	41538374868278621028243970633760768	83076749736557242056487941267521536	166153499473114484112975882535043072	332306998946228968225951765070086144	664613997892457936451903530140172288	1329227995784915872903807060280344576	2658455991569831745807614120560689152	5316911983139663491615228241121378304	10633823966279326983230456482242756608	21267647932558653966460912964485513216	42535295865117307932921825928971026432	85070591730234615865843651857942052864	170141183460469231731687303715884105728	340282366920938463463374607431768211456	680564733841876926926749214863536422912	1361129467683753853853498429727072845824	2722258935367507707706996859454145691648	5444517870735015415413993718908291383296	10889035741470030830827987437816582766592	21778071482940061661655974875633165533184	43556142965880123323311949751266331066368	87112285931760246646623899502532662132736	174224571863520493293247799005065324265472	348449143727040986586495598010130648530944	696898287454081973172991196020261297061888	1393796574908163946345982392040522594123776	2787593149816327892691964784081045188247552	5575186299632655785383929568162090376495104	11150372599265311570767859136324180752990208	22300745198530623141535718272648361505980416	44601490397061246283071436545296723011960832	89202980794122492566142873090593446023921664	178405961588244985132285746181186892047843328	356811923176489970264571492362373784095686656	713623846352979940529142984724747568191373312	1427247692705959881058285969449495136382746624	2854495385411919762116571938898990272765493248	5708990770823839524233143877797980545530986496	11417981541647679048466287755595961091061972992	22835963083295358096932575511191922182123945984	45671926166590716193865151022383844364247891968	91343852333181432387730302044767688728495783936	182687704666362864775460604089535377456991567872	365375409332725729550921208179070754913983135744	730750818665451459101842416358141509827966271488	1461501637330902918203684832716283019655932542976	2923003274661805836407369665432566039311865085952	5846006549323611672814739330865132078623730171904	11692013098647223345629478661730264157247460343808	23384026197294446691258957323460528314494920687616	46768052394588893382517914646921056628989841375232	93536104789177786765035829293842113257979682750464	187072209578355573530071658587684226515959365500928	374144419156711147060143317175368453031918731001856	748288838313422294120286634350736906063837462003712	1496577676626844588240573268701473812127674924007424	2993155353253689176481146537402947624255349848014848	5986310706507378352962293074805895248510699696029696	11972621413014756705924586149611790497021399392059392	23945242826029513411849172299223580994042798784118784	47890485652059026823698344598447161988085597568237568	95780971304118053647396689196894323976171195136475136	191561942608236107294793378393788647952342390272950272	383123885216472214589586756787577295904684780545900544	766247770432944429179173513575154591809369561091801088	1532495540865888858358347027150309183618739122183602176	3064991081731777716716694054300618367237478244367204352	6129982163463555433433388108601236734474956488734408704	12259964326927110866866776217202473468949912977468817408	24519928653854221733733552434404946937899825954937634816	49039857307708443467467104868809893875799651909875269632	98079714615416886934934209737619787751599303819750539264	196159429230833773869868419475239575503198607639501078528	392318858461667547739736838950479151006397215279002157056	784637716923335095479473677900958302012794430558004314112	1569275433846670190958947355801916604025588861116008628224	3138550867693340381917894711603833208051177722232017256448	6277101735386680763835789423207666416102355444464034512896	12554203470773361527671578846415332832204710888928069025792	25108406941546723055343157692830665664409421777856138051584	50216813883093446110686315385661331328818843555712276103168	100433627766186892221372630771322662657637687111424552206336	200867255532373784442745261542645325315275374222849104412672	401734511064747568885490523085290650630550748445698208825344	803469022129495137770981046170581301261101496891396417650688	1606938044258990275541962092341162602522202993782792835301376	3213876088517980551083924184682325205044405987565585670602752	6427752177035961102167848369364650410088811975131171341205504	12855504354071922204335696738729300820177623950262342682411008	25711008708143844408671393477458601640355247900524685364822016	51422017416287688817342786954917203280710495801049370729644032	102844034832575377634685573909834406561420991602098741459288064	205688069665150755269371147819668813122841983204197482918576128	411376139330301510538742295639337626245683966408394965837152256	822752278660603021077484591278675252491367932816789931674304512	1645504557321206042154969182557350504982735865633579863348609024	3291009114642412084309938365114701009965471731267159726697218048	6582018229284824168619876730229402019930943462534319453394436096	13164036458569648337239753460458804039861886925068638906788872192	26328072917139296674479506920917608079723773850137277813577744384	52656145834278593348959013841835216159447547700274555627155488768	105312291668557186697918027683670432318895095400549111254310977536	210624583337114373395836055367340864637790190801098222508621955072	421249166674228746791672110734681729275580381602196445017243910144	842498333348457493583344221469363458551160763204392890034487820288	1684996666696914987166688442938726917102321526408785780068975640576	3369993333393829974333376885877453834204643052817571560137951281152	6739986666787659948666753771754907668409286105635143120275902562304	13479973333575319897333507543509815336818572211270286240551805124608	26959946667150639794667015087019630673637144422540572481103610249216	53919893334301279589334030174039261347274288845081144962207220498432	107839786668602559178668060348078522694548577690162289924414440996864	215679573337205118357336120696157045389097155380324579848828881993728	431359146674410236714672241392314090778194310760649159697657763987456	862718293348820473429344482784628181556388621521298319395315527974912	1725436586697640946858688965569256363112777243042596638790631055949824	3450873173395281893717377931138512726225554486085193277581262111899648	6901746346790563787434755862277025452451108972170386555162524223799296	13803492693581127574869511724554050904902217944340773110325048447598592	27606985387162255149739023449108101809804435888681546220650096895197184	55213970774324510299478046898216203619608871777363092441300193790394368	110427941548649020598956093796432407239217743554726184882600387580788736	220855883097298041197912187592864814478435487109452369765200775161577472	441711766194596082395824375185729628956870974218904739530401550323154944	883423532389192164791648750371459257913741948437809479060803100646309888	1766847064778384329583297500742918515827483896875618958121606201292619776	3533694129556768659166595001485837031654967793751237916243212402585239552	7067388259113537318333190002971674063309935587502475832486424805170479104	14134776518227074636666380005943348126619871175004951664972849610340958208	28269553036454149273332760011886696253239742350009903329945699220681916416	56539106072908298546665520023773392506479484700019806659891398441363832832	113078212145816597093331040047546785012958969400039613319782796882727665664	226156424291633194186662080095093570025917938800079226639565593765455331328	452312848583266388373324160190187140051835877600158453279131187530910662656	904625697166532776746648320380374280103671755200316906558262375061821325312	1809251394333065553493296640760748560207343510400633813116524750123642650624	3618502788666131106986593281521497120414687020801267626233049500247285301248	7237005577332262213973186563042994240829374041602535252466099000494570602496	14474011154664524427946373126085988481658748083205070504932198000989141204992	28948022309329048855892746252171976963317496166410141009864396001978282409984	57896044618658097711785492504343953926634992332820282019728792003956564819968	115792089237316195423570985008687907853269984665640564039457584007913129639936	231584178474632390847141970017375815706539969331281128078915168015826259279872	463168356949264781694283940034751631413079938662562256157830336031652518559744	926336713898529563388567880069503262826159877325124512315660672063305037119488	1852673427797059126777135760139006525652319754650249024631321344126610074238976	370534685559411825355427152027801305130463950930049804926264268825322014847
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### Problem 15

hosts : 50

Network Address : 172.59.0.0

Address Class : B

Default Mask : 255.255.0.0

Custom Mask : ~~255.255.10.0~~ 255.255.255.192

Total Subnets : 1024

Total hosts : 64

Usable Addresses : 62

bits borrowed : 10

HOSTS : ~

$2^{64-32}$  16842 - need 50 hosts

subnets -

- no subnets

Binary -

172.59.0000 0000. 0000 0000  $\rightarrow$  10 bit borrowed

$2^{10} \rightarrow$  Subnets



## Subnetting Problem 11

Hosts : 8000

Network Address : 135.70.0.0

Address Class : B

Default Mask : 255.255.0.0

Custom Mask : 255.255.224.0

Total Subnets : 8

Total Hosts : 8192

Usable Addresses : 8190

bits borrowed : 3

6<sup>th</sup> Subnet Range : 135.70.160.0 → 135.70.191.254

7<sup>th</sup> Subnet Number : 135.70.192.0

3<sup>rd</sup> Subnet broadcast Address : 135.70.95.255

assignable Address for 5<sup>th</sup> : 135.70.128.0

8192 = 2<sup>13</sup> = 8192  
255.255.224.0 = 16892

135.70.0000.0000.0000.0000 : 3 remaining to 3 <sup>sub</sup> ~~sub~~

111 0 0000 → 224

1	135.70.0.0 → 135.70.31.254	0001 1111.1111 1111
2	135.70.32.0 → 135.70.63.254	0010 1111.1111 1111
3	135.70.64.0 → 135.70.95.254	0011 1111.1111 1111
4	135.70.96.0 → 135.70.127.254	0100 1111.1111 1111
5	135.70.128.0 → 135.70.159.254	0101 1111.1111 1111
6	135.70.160.0 → 135.70.191.254	0110 1111.1111 1111
7	135.70.192.0 → 135.70.223.254	0111 1111.1111 1111
8	135.70.224.0 → 135.70.255.254	1000 1111.1111 1111

$$32 - 19 = 13 \quad 2^{13} = 8192$$

$$8192 / 255 = 32$$

### Subnetting Problem 12

Hosts : 45

Network Address : 198.125.50.0

Address Class : C

Default Mask : 255.255.255.0

Custom Mask : 255.255.255.192

Total Subnets : 4 ( $2^2$ )

Total Hosts : 64

Usable Hosts : 62

Bits Borrowed : 2

2<sup>nd</sup> subnet Range : 198.125.50.64 → 198.125.50.127

2<sup>nd</sup> subnet Number : 198.125.50.64

4<sup>th</sup> subnet broadcast address : 198.125.50.255

3<sup>rd</sup> Assignable address : 198.125.50.128

Host

Subnet

Binary

198.125.50.0000 0000 → 2 remaining so 2 <sup>bits</sup> ~~bits~~  
11 00 0000 → 192 in binary

198.125.50.0 → 198.125.50.63

198.125.50.64 → 198.125.50.127

198.125.50.128 → 198.125.50.191

198.125.50.192 → 198.125.50.255

$32 - 26 = 6$      $2^6 = 64$



Practical Subnetting 4  $\rightarrow 135.126.0.0$

Address Class	0	13	240
Custom subnet	0	255, 255, <del>252</del> 0	
M.n Subnets	0	5	
extra subnets for 70%	0	4	
total subnets	0	9	
Num Hosts in largest Subnet	0	325	
Num addresses needed for 70%+	0	228	
Total addresses for largest subnet	0	583	

IP address range for NY: 135.126.0.0  $\rightarrow$  135.126.15.255

IP address range for Washington D.C. = 135.126.16.0 → 135.126.31.255

IP address range for Dallas: 135.126.32.0 → 135.126.47.255

range for A-B serial connection: 135.126.48.0 → 135.126.63.255

range for A-C serial connection 135.126.64.0  $\rightarrow$  135.126.79.255

Haupt  
summe  
Bauy

$\begin{array}{r|l} 29816 & \\ \hline 1111 & 0000 \end{array}$

$= 240$

$135.126.0000 | 0000.0000.0000$

$0000 | 1111 \rightarrow 15$

$32 - 20 = 12$

$2^{12} = 4096$

$2^{10} = 1024$

1  $135.126.0.0 \rightarrow 135.126.15.255$

2  $135.126.16.0 \rightarrow 135.126.31.255$

3  $135.126.32.0 \rightarrow 135.126.47.255$

4  $135.126.48.0 \rightarrow 135.126.63.255$

5  $135.126.64.0 \rightarrow 135.126.79.255$

6  $135.126.80.0 \rightarrow 135.126.95.255$

7  $135.126.96.0 \rightarrow 135.126.111.255$

8  $135.126.112.0 \rightarrow 135.126.127.255$

9  $135.126.128.0 \rightarrow 135.126.143.255$

$\frac{4096}{255} = 16$



Practical Subnetting 6 - 10.0.0.0

Class : A

Custom Mark: 255, 240, 010 455, 255, 240, 010 (255, 240, 00)

M.n Subnets needed: 7

+20% growth : 2

Total subnets: 9

Host in largest: 320

+20% growth : 64

Total addresses in largest: 384

Host	5/2	16542	9	9 heads
Subnet	24816		0	4 subnet
Binary				

10. 0000 0000 . 0000 0000 . 0000 0000 0000 : 824 + 0 + 0  
1111 0000 - 0000 0000 . 0000 0000 0000 → mask

10.0.0.0  $\rightarrow$  10.0.1.255

2 10.0.2.0  $\rightarrow$  10.0.3.255

3  $10.0.4.0 \rightarrow 10.0.5.255$

4 10.0.6.0  $\rightarrow$  10.0.7.255

5  $10.0.8.0 \rightarrow 10.0.9.255$

6  $10.0.10.0 \rightarrow 10.0.11.255$

7 10.0.12.0  $\rightarrow$  10.0.13.255

$$32 - 12 = 20 \quad 2^{20} =$$
  

$$2^4 = \underline{16}$$

Technology : 10.0.0.0  $\rightarrow$  10.0.1.255

$$512/255 = 2$$

Science : 10.0.2.0  $\rightarrow$  10.0.3.255

Art + Preis: 10.04.0 → 10.05.255

Admin ~~A/B~~ : 10.0.6.0 → 10.0.7.255

A-B ~~A-E~~ : 10.0.2.0 → 10.0.9.255

~~A-C~~ ~~B-E~~ : 10.0 10.0  $\rightarrow$  10.0 11.255

B-C  $\checkmark$  10.0.12.0  $\rightarrow$  10.0.13.255