Find Your Group / Table

Last name	First name	Group
Aasbø	Felix Leon Johnsen	6B
Ackerman	Maan	1A
Ådlandsvik	Jonathan Ward	6A
Alhajeed	Suha	2A
Bækken	Frida Nordnes	3A
Bang-Olsen	Andreas Isegran	8A
Berwari	Kurdin Bekes	2A
Bjørkum	Hans Skirstad	8B
Borch	Christian Uteng	5A
Bratsvedal	Adam Paalsrud	6B
Cincovic	Leon	1A
Dalbye	Karin Ingrid Marie	4A
Flatberg	Odin	9B
Gerhardsen	Trym Silsand	8B
Gulljord	Kaisa	5A
Håkonsen	Sondre Songedal	8A
Hansen	Frida Andrea	6A
Hauksson	Daniel Örn	8B
Heggem	Ingrid Grov	7A

Last name	First name	Group
Hegre	Torjus Meyer	1A
Helgesen	Sander	9B
Henriksen	Daniel	2A
Iden	Erika	8A
Jægersborg-Iversen	Olav	3B
Johansen	Justine Sønsteli	9A
Korterud	Jacob Weldingh	7A
Lervik	Liv Barstad	1B
Lutnæs	Tørres	5B
Makhtari	Mohand	9A
Melsnes	Maria Olsen	2B
Migliorini	Mika Gabriel Holst	5B
Mosfjell	Jonathan	1B
Muruganandan	Anarththan Achshathan	3A
Myrland	Viktor	4B
Nguyen	Christoffer Hoang	3B
Ommundsen	Kristoffer Sørli	9A
Opdøl	Oskar	1B

Last name	First name	Group
Paheerathan	Rithaann	4B
Pettersen	Henrik	4A
Rian	Tobias	7A
Robstad	William	7B
Rosvoldaunet	Annika Olaussen	7B
Sævareid	Olav Onstad	7B
Salte	Sigrid	4B
Skjerve	Eskil Andreas Kjønstad	3A
Sonerud	Mina Kibsgård	5B
Torp	Sindre André Svendsrud	2B
Trælandshei	Jørgen	6A
Udnæs	Andrea Charlotte Ribe	6B
Valle	Ole Gustav	9B
Vikingstad	Viktor Westerberg	4A
Vist	Sigrid	3B
Walderhaug-Johnsen	Adrian	2B
Willoch	Caroline	8B
Wittner	Herman	5A

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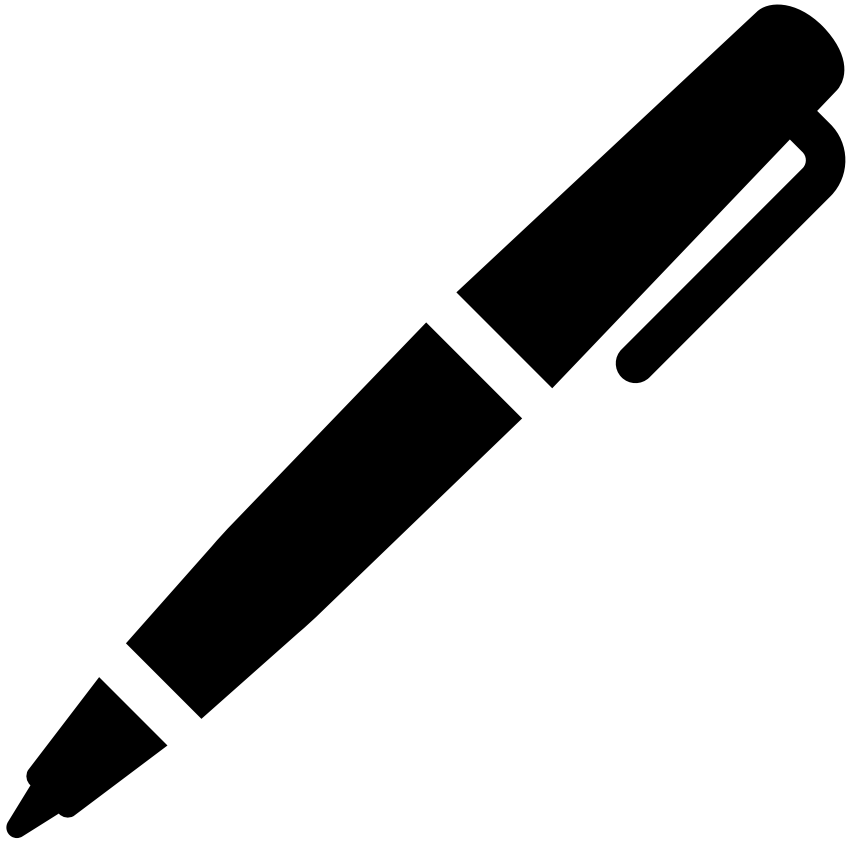
TTM4175 – Week 35

Net 1 – IP Addresses and Binary Representation, Routing

iRATs

- ✓ Make sure you have the sheet that has your name on it
- ✓ Solve individually, silently, without extra resources (hjelpemiddler)
- ✓ Don’t forget the checksum
- ✓ Please place your (student) ID on the table

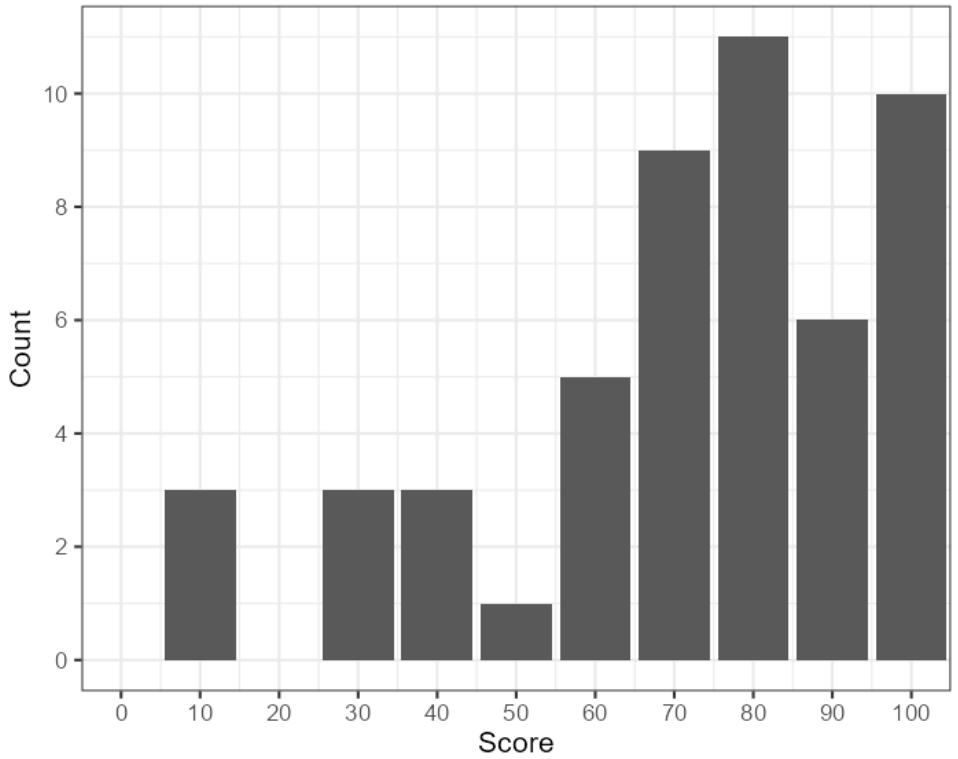


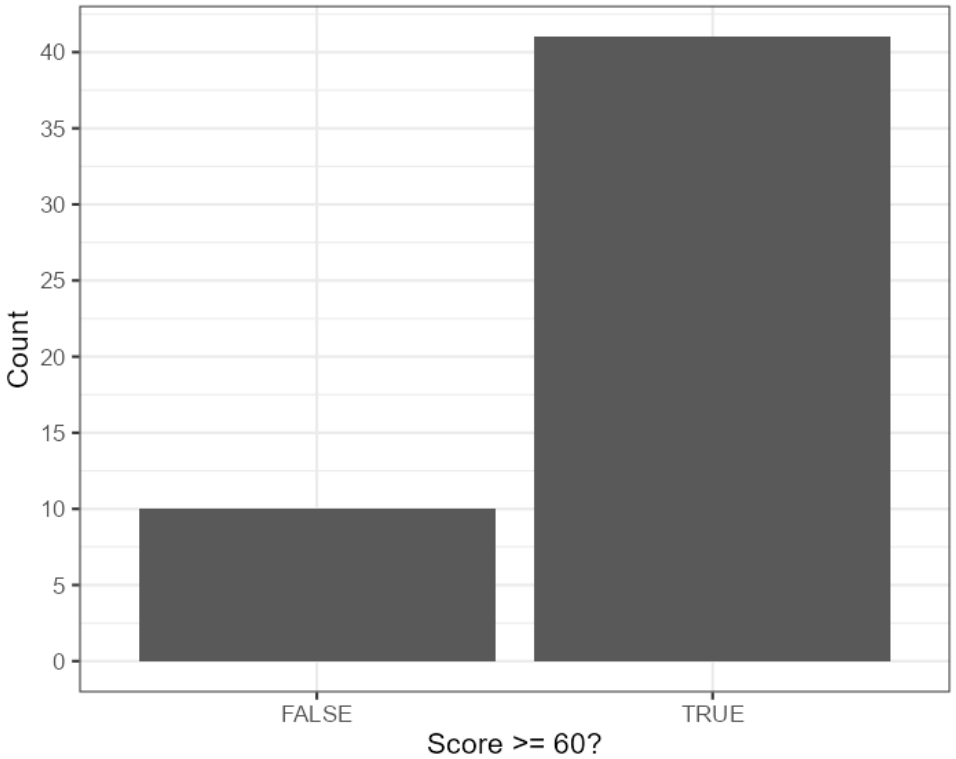
12:00

tRATs - Get the Nøtteknekker App

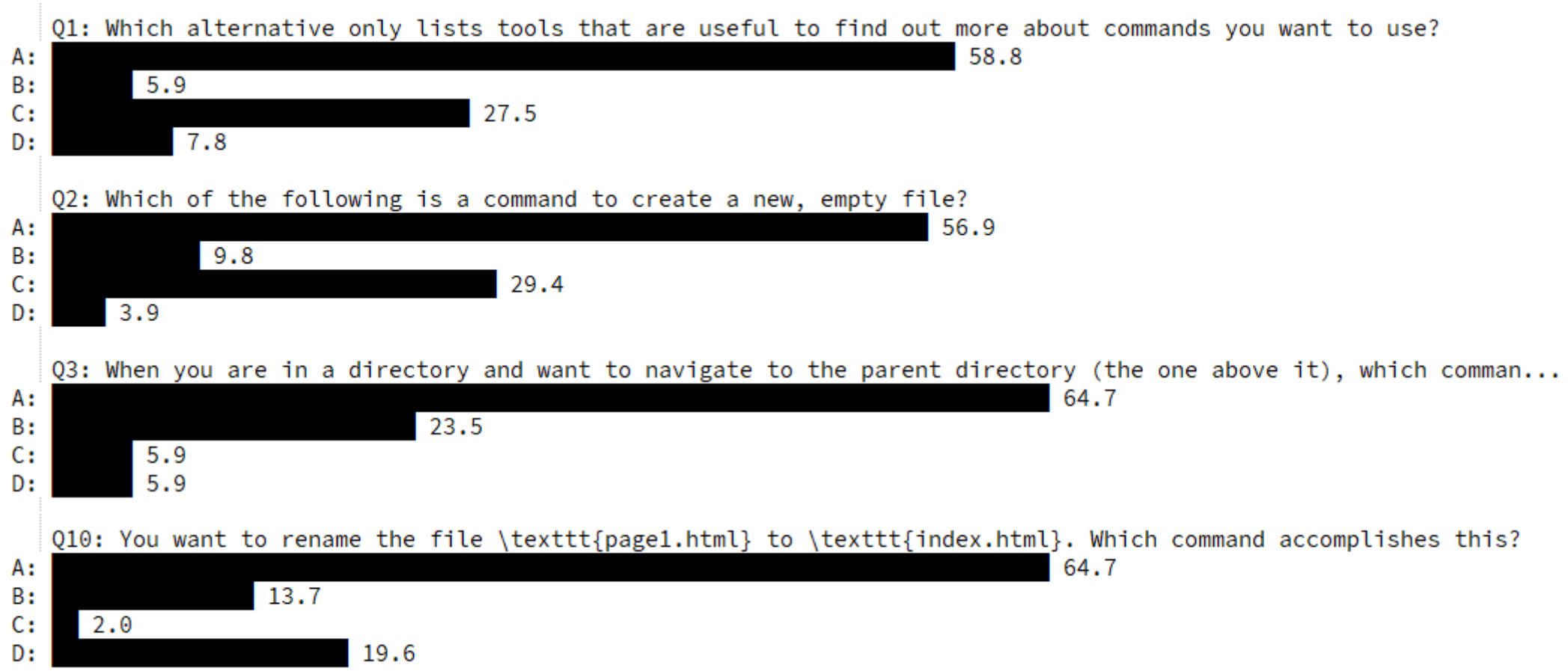
12:00

RATs Week 34


Count
Score
0
2
4
6
8
10
0
10
20
30
40
50
60
70
80
90
100


Count
Score >= 60?
0
5
10
15
20
25
30
35
40
FALSE
TRUE

RATs Week 34

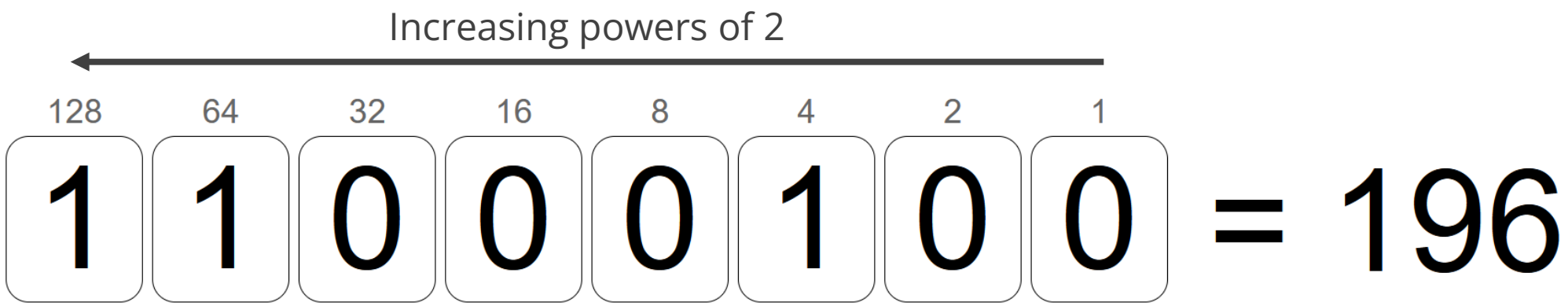

Q1: Which alternative only lists tools that are useful to find out more about commands you want to use?
A: 58.8
B: 5.9
C: 27.5
D: 7.8
Q2: Which of the following is a command to create a new, empty file?
A: 56.9
B: 9.8
C: 29.4
D: 3.9
Q3: When you are in a directory and want to navigate to the parent directory (the one above it), which comman...
A: 64.7
B: 23.5
C: 5.9
D: 5.9
Q10: You want to rename the file \texttt{page1.html} to \texttt{index.html}. Which command accomplishes this?
A: 64.7
B: 13.7
C: 2.0
D: 19.6

Goals – Week 35

- Understand and apply basic **binary arithmetic**
- Understand **IP addresses** and **subnets**
- Create and configure **Local Area Networks (LANs)**
- Use basic **Linux commands** for managing
  - IP addresses (IPv4 and IPv6)
  - IP subnets and masks

Recap – Binary

- Number system that uses only **bi**nary digi**ts** 0 and 1
- Common grouping: 8 bits = 1 octet = 1 byte
  - Possible values from 0 (0000 0000) to 255 (1111 1111)
- Given n bits, we can represent 2^n numbers
  - 8 bits → 256 numbers, 32 bits → 4 294 967 296 numbers



https://www.advanced-ict.info/interactive/binary.html

Binary Arithmetic – AND Operator

- Defined via **truth table**

a	b	a AND b
0	0	0
0	1	0
1	0	0
1	1	1

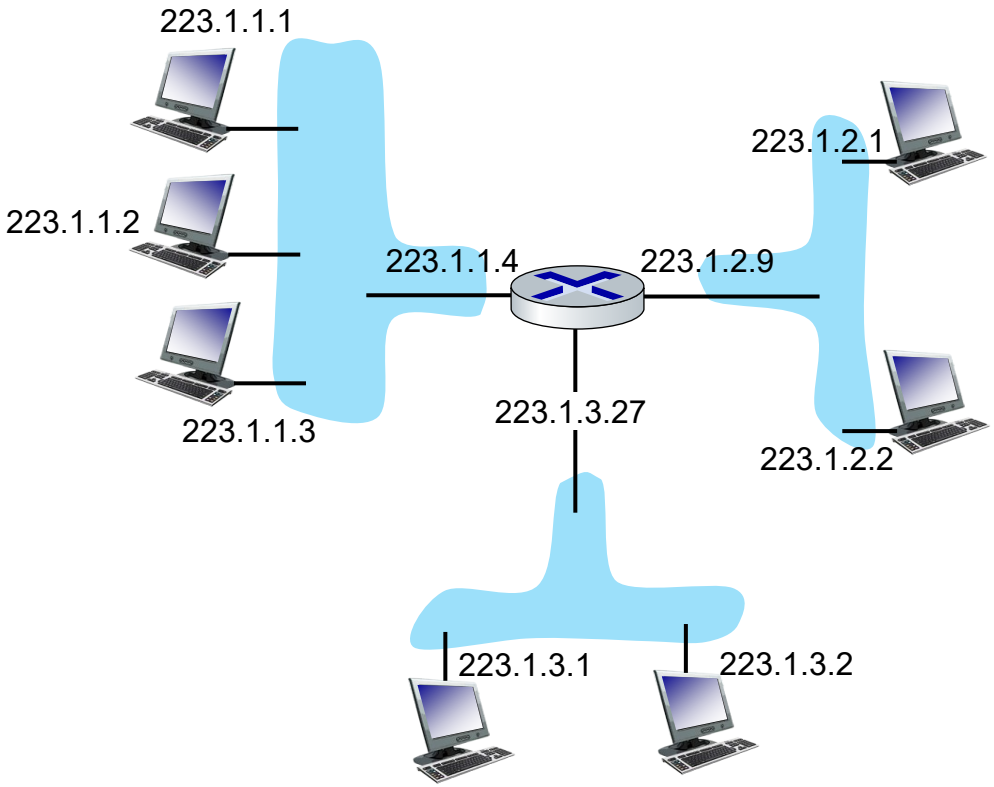
Expression	Value
x_1	1011 0111
x_2	1111 1100
$x_1\ AND\ x_2$	1011 0100

Bit-mask to extract first 6 bits of x_1

- Often used in programming to check multiple conditions
- Bit-wise application to a pair of same-length bit strings allows extracting sub-strings

IP Addressing

- IP address: 32-bit identifier associated with each host or router *interface*
- Interface: connection between host/router and physical link
  - Routers typically have multiple interfaces
  - Host typically has one or two interfaces (e.g., wired, wireless)



Dotted-decimal IP address notation

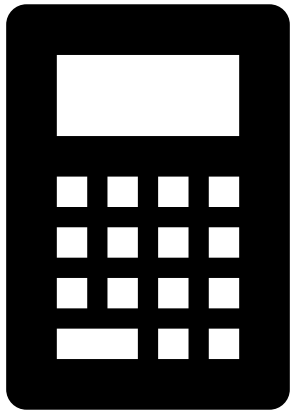
223.1.1.1 = 11011111 00000001 00000001 00000001

223 1 1 1

Binary, IP – Exercise

1. Convert `172.16.254.35` to binary
2. Construct a bit mask to extract the **first 24** bits from the result
3. Apply the mask to the address in 1.
4. Convert the bit mask and the result back to dotted decimal

Check slide 11



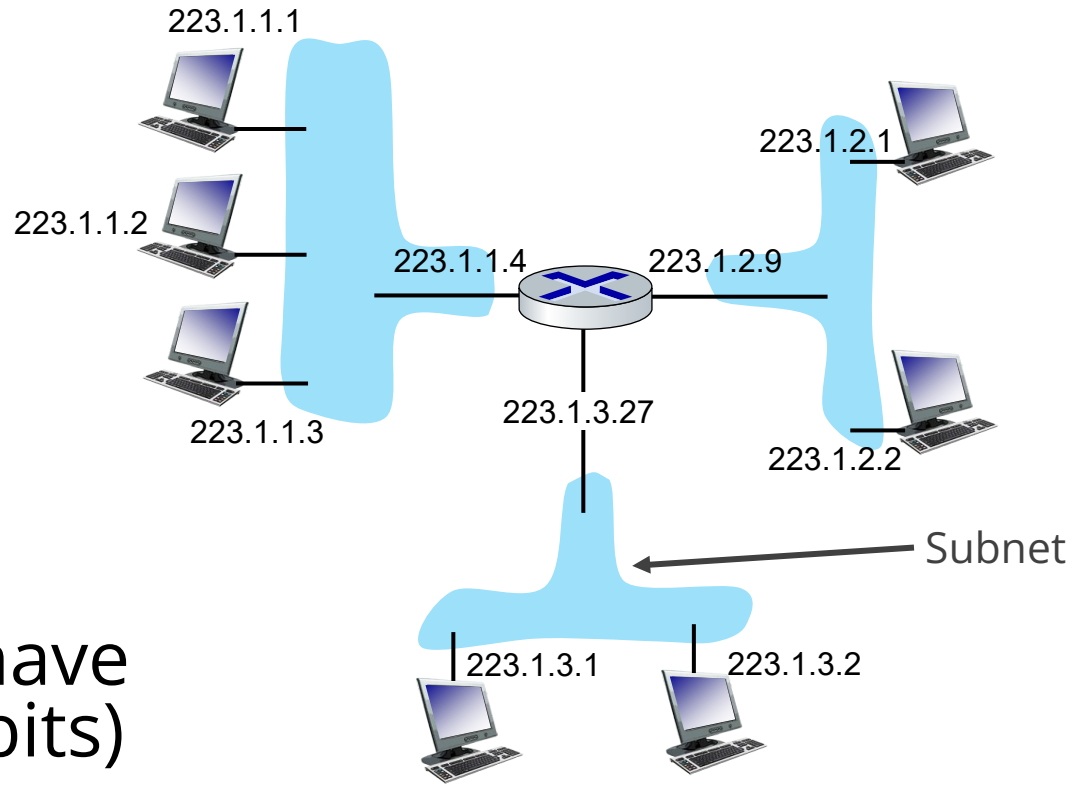
10:00

https://www.advanced-ict.info/interactive/binary.html
https://www.rapidtables.com/calc/math/binary-calculator.html - ! note: use and(&) and not add(+) !

Subnets

- *What's a subnet?*
  - Device interfaces that can physically reach each other without passing through an intervening router
- IP addresses have structure
  - Subnet part: devices in a subnet have common high order bits (=first n bits)
  - Host part: remaining low order bits (=remaining $32 - n$ bits)

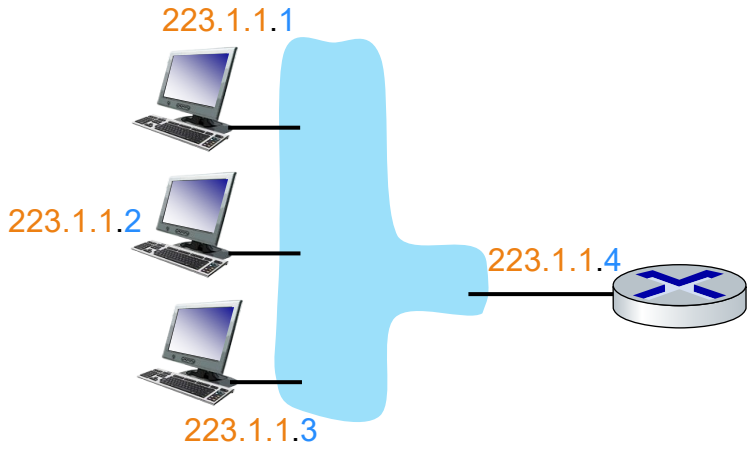
➔ Organization, security, manageability



Network with 3 subnets

Subnets

- IP addresses have structure
  - Subnet part: devices in a subnet have common high order bits (=first n bits)
  - Host part: remaining low order bits (=remaining $32 - n$ bits)



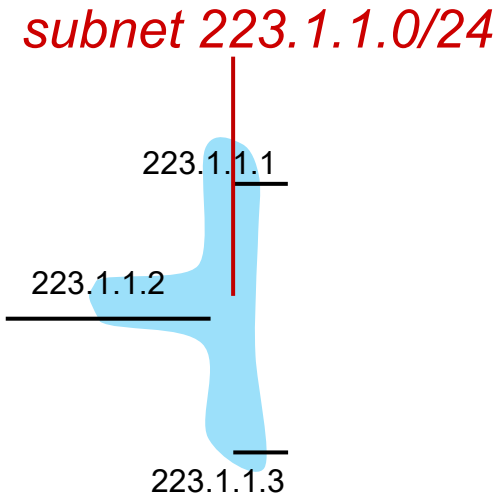
- Subnet mask defines a subnet, determining the size and IP address range of the subnet
  - Example: IP 223.1.1.1 and mask 255.255.255.0
  - Common notation
    - 223.1.1.0/24 to refer to the subnet
    - 223.1.1.1/24 to refer to the IP address

First 24 bits are ones

Subnets – Example

Length of subnet part

- 223.1.1.0/24
- 11011111 00000001 00000001 00000000
- Subnet part, host part
- Available addresses in subnet
  - 11011111 00000001 00000001 00000000
  - 11011111 00000001 00000001 00000001
  - …
  - 11011111 00000001 00000001 11111110
  - 11011111 00000001 00000001 11111111



Special reserved addresses (network address, broadcast address) that **can't** be assigned to an interface

Subnets – Exercise

10:00

- Given the IP address `172.31.207.109/24`,
  1. Determine the first / last address in the subnet
  2. Determine the number of addresses in the subnet
  3. How do the answers to 1 and 2 change in case of a /20 subnet?

https://jodies.de/ipcalc

Private Subnets

- Best practice to use subnets from these ranges when setting up local networks – RFC 1918 https://datatracker.ietf.org/doc/html/rfc1918
  - 10.0.0.0
    - Subnet Mask 255.0.0.0 (/8)
  - 172.16.0.0
    - Subnet Mask 255.240.0.0 (/12)
  - 192.168.0.0
    - Subnet Mask 255.255.0.0 (/16)
- Longer masks commonly used, e.g., 192.168.1.0/24

Remember: The first and last address of a subnet are reserved!

https://www.gns3.com/assets/custom/gns3/images/logo-colour.png

Lab Program Today

- Create your own local network in GNS3
- Learn how to use the CLI to
  - Get interface information
  - Set IP addresses
  - Check connectivity using `ping`
- Explore subnet masks

[Demo] GNS3 Basics

- Nodes
- Links
- Start / stop / restart
- Opening a console on hosts

Next Week: Networking Lab II

- Topics: ports, layers, client-server arch., web servers
- Goals
  - Recognize the importance of ports in networking
  - Understand how computer networking is organized into protocol layers
  - Get familiar with the popular client-server architecture for network-based services and see it applied with a web server
- Preparation material & BB announcement on Monday
- ! Remember the reflections after the lab