SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

CMPT 120: Introduction to Computing Science and Programming 1

Binary Encoding / Representation

Reminders

One-Stop Access To Course Information

- **Course website**: **One-stop access** to all course information.

  http://www2.cs.sfu.ca/CourseCentral/120/liaqata/WebSite/index.html

- Course Outline
- Exam Schedule
- Python Info
- CourSys/Canvas link
- Learning Outcomes
- Office Hours
- Textbook links
- and more…
- Grading Scheme
- Lab/Tutorial Info
- Assignments

- **Canvas**: Discussions forum - https://canvas.sfu.ca/courses/39187
- **CourSys**: Assignments submission, grades - www.coursys.sfu.ca

How to Learn in This Course?

A — **Attend** Lectures & Labs

R — **Read** / review Textbook/Slides/Notes

R — **Reflect** and ask Questions

O — **Organize** – your learning activities on weekly basis,

and finally…

W — **Write** Code, Write Code, and Write Code.

Deliverables

1. Deliverables are due by the given date and time.
2. For the course, we are using IDLE to write and run our Python code.
3. You can use the CSIL lab computers outside your lab hours.
4. Plan ahead your assignments and other deliverables. Computer crash, network problems etc. are not acceptable excuses for delays in deliverables.
5. You may use online Python interpreters for running and testing your codes, such as:

   https://repl.it/languages/Python3

Labs

1. Each lab has an assigned TA.
2. Attend your assigned lab and show your work to your TA for the participation marks.
3. Class enrolments and lab swaps are closed now.

Course Topics

1. General introduction
2. Algorithms, flow charts and pseudocode
3. Procedural programming in Python
4. Data types and Control Structures
5. Fundamental algorithms
6. Binary encodings
7. Basics of computability and complexity
8. Basics of Recursion
9. Subject to time availability:
   - Basics of Data File management

Today's Topics

1. Data Representation (Binary Encoding)
   - ASCII
   - Unicode
   - Storage Units
   - Binary Addition

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Data Representation

Number Systems: Representation and Position Values

- In our common day life we use the Decimal Number System, only.
- We write **11**:
  - it is understood that we talking about the decimal number system.
  - We know it represents **Eleven**.
- But, what it **11** is a binary number?
  - It then would mean **3**.
- How can we can distingue number systems?
- One way is t use notation: $\mathbf{Number}_{base}$

- So, write decimal **11** (base 10) as: $\mathbf{11}_{10}$
  - $\mathbf{11}_{10}$ thus represents **Eleven.**
  - Base 10 position values:

10^2	10^1	10^0

- We write 11 in base 2 as: $\mathbf{11}_{2}$
  - $\mathbf{11}_{2}$ in Binary thus represents **three**.
  - Base 2 position values:

2^2	2^1	2^0

- Similarly, we can write 11 in base 16 (hexadecimal) as: $\mathbf{11}_{16}$
  - $\mathbf{11}_{16}$ in hexadecimal means **Seventeen.**
  - Base 16 position values:

16^2	16^1	16^0

Storage Units

- **Bit**: storage to represent a **binary** 0 or 1.
- **Byte**: a group of 8-bits.
- More bigger storage units (with approximation, as shown in Study Guide):

Prefix	Symbol	Factor
(no prefix)		$2^0 = 1$
kilo-	k	$2^{10} = 1024 \approx 10^3$
mega-	M	$2^{20} = 1048576 \approx 10^6$
giga-	G	$2^{30} = 1073741824 \approx 10^9$
tera-	T	$2^{40} = 1099511627776 \approx 10^{12}$

- Example, "**12 megabytes**" is: **12 × 2**^{20} bytes
- = **12,582,912** bytes =>

12582912 × 8 bits = **100,663,296** bits .

- **More specifically:**

Multiples of bytes V·T·E

Decimal			Binary				
Value	Metric		Value	IEC		JEDEC	
1000	kB	kilobyte	1024	KiB	**kibibyte**	KB	kilobyte
1000^2	MB	megabyte	1024^2	MiB	mebibyte	MB	megabyte
1000^3	GB	gigabyte	1024^3	GiB	gibibyte	GB	gigabyte
1000^4	TB	terabyte	1024^4	TiB	tebibyte	–	
1000^5	PB	petabyte	1024^5	PiB	pebibyte	–	
1000^6	EB	exabyte	1024^6	EiB	exbibyte	–	
1000^7	ZB	zettabyte	1024^7	ZiB	zebibyte	–	
1000^8	YB	yottabyte	1024^8	YiB	yobibyte	–	

Orders of magnitude of data

Quiz 1

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Questions?