Hes·so VALAIS WALLIS

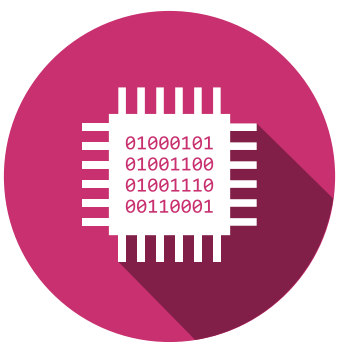
Haute Ecole d'Ingénierie
Hochschule für Ingenieurwissenschaften

Conception numérique (DiD)

Introduction

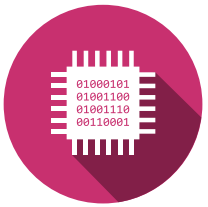
IND

Filière Systèmes industriels
Filière Energie et techniques environmentales
Filière Informatique et systèmes de communications



Silvan Zahno silvan.zahno@hevs.ch
Christophe Bianchi christophe.bianchi@hevs.ch
François Corthay francois.corthay@hevs.ch

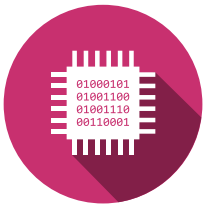
ISC Modules 1ère année



https://www.hevs.ch/media/document/20/plan-etude-isc-v1-02.pdf

	Cours	*Heures*	*Crédits*
1ère année	**Semestre 1**	**32**	**28**
	Algèbre linéaire 1	4	4
	Analyse 1	6	5
	Communication 1	2	2
	Ethique et aspects juridiques	2	2
	Langues 1	4	3
	Programmation impérative	8	7
	Systèmes numériques	*6*	*5*
	Semestre 2	**36**	**32**
	Algèbre linéaire 2	4	4
	Analyse 2	6	5
	Architecture des ordinateurs	*4*	*3*
	Communication 2	2	2
	Intro. à la sécurité	4	3
	Langues 2	4	3
	Programmation objet	8	6
	Réseaux	4	6
	Projet 1	Summer school	3

But du cours



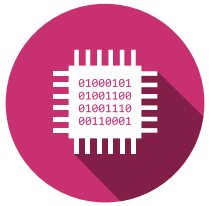
Savoir interpréter le cahier des charges fonctionnel d'un système simple (C) et le représenter sous forme numérique (A)

Appliquer les principes de base de la conception numérique selon les méthodologies proposées (A)

Réaliser la fonction logique qui en découle (A)

Valider la conception numérique réalisée selon les méthodologiques de simulation et de test (J)

Contenu du cours



Cahier des charges

MSb **NUM** LSb

11110101

Binary dig**IT**

a	b	y
0	0	0
0	1	1
1	0	1
1	1	0

Table de vérité

KAR

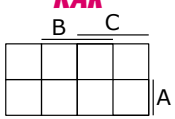
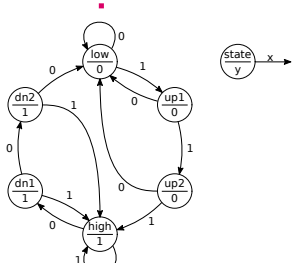


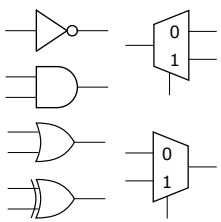
Table de Karnaugh

Q_A	Q_B	Q_A^+	Q_B^+
0	0	1	0
0	1	0	0
1	0	1	1
1	1	0	1

Table d'état



COM **MUX**



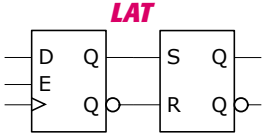
Eléments de logique combinatoire

$$y = a(b + c) = ab + ac$$

Equation polynomiale

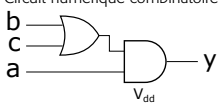
$$Q_0^+ = \overline{Q_0}$$
$$Q_1^+ = Q_0 \oplus Q_1$$

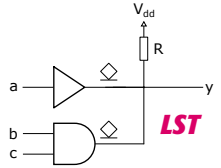
LAT



Eléments de logique séquentielles

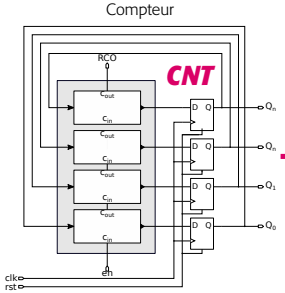
Circuit numérique combinatoire





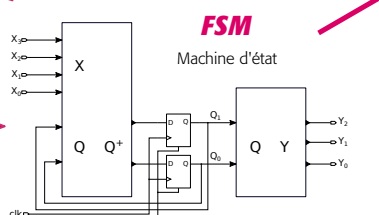
LST

Compteur

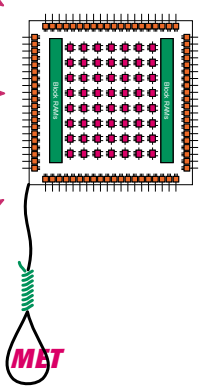


FSM

Machine d'état

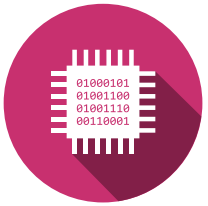


FPGA



MET

Blague



There are 10 types of people in this world. Those who understand binary and those who don’t.

Il y a 10 types de personnes dans ce monde. Ceux qui comprennent le binaire et ceux qui ne le comprennent pas.

Map of Computer Science

THEORETICAL COMPUTER SCIENCE

COMPUTATIONAL COMPLEXITY
DOES P≠NP?
NXN CHESS PSPACE NXNGO
NP COMPLETE
TRAVELLING SALESMAN MAP COLOURING
NP GRAPH ISOMORPHISM
BQP
EFFICIENT FOR A QUANTUM COMPUTER
DISCRETE LOGARITHM FACTORING
EFFICIENT FOR A COMPUTER
P
TESTING IF PRIME GRAPH CONNECTIVITY

INFORMATION THEORY
0100110100011001
COMPRESSION
ENTROPY
ERROR CORRECTION
CODING THEORY
PARITY CHECKING

CRYPTOGRAPHY
PUBLIC KEY
ALL THE SECRETS
7bh;"
%gmP
$avr
PRIVATE KEY

COMPUTABILITY THEORY
LOGIC
ZERO ONE OR NOT AND XOR NAND
GRAPH THEORY
COMPUTATIONAL GEOMETRY

TURING MACHINE
ALAN TURING
STATE REGISTER
1: MOVE LEFT
2: MOVE RIGHT
3: FLIP DIGIT
123: STOP
INFINITELY LONG TAPE
HEAD
LAMBDA CALCULUS

AUTOMATA THEORY
QUANTUM COMPUTATION
AND MORE
PARALLEL PROGRAMMING
JOB 1
JOB 2
JOB 3
JOB 4
MAIN JOB
SMALLER JOBS

ALGORITHMS
BUBBLESORT(A)
1: GO FROM LEFT TO RIGHT.
2: COMPARE EACH PAIR.
3: IF LEFT ONE HIGHER, SWITCH.
4: DO UNTIL NO MORE SWITCHES.
BUBBLE SORT O(n²)
1 2 3 4 5 6 7 8
MERGE SORT O(n log n)
1 2 3 4 5 6 7 8
ANALYSIS OF ALGORITHMS
ALGORITHMIC COMPLEXITY

DATA STRUCTURES
LINKED LIST
TREE
GRAPH
STACK
HASHING
LIST

FORMAL METHODS
START
POSSIBLE STATES
ALERT

COMPUTER ENGINEERING

HARDWARE
MONITOR
SOUND
SSD
CPU
RAM
INPUT
POWER
MOTHERBOARD

SCHEDULING
PROCESSES
SCHEDULER
CPU 1 CPU 2 CPU 3 CPU 4
MULTIPROCESSING

COMPUTER ARCHITECTURE
CPU
CENTRAL PROCESSING UNIT
CONTROL UNIT
ARITHMETIC/LOGIC UNIT
MEMORY UNIT
INPUT
OUTPUT
GPU
MULTIPROCESSORS
FPGA
LOGIC BLOCK
INTERCONNECTION
INPUT/OUTPUT
SWITCH BOX
CONNECT BLOCK

SOFTWARE AND PROGRAMMING LANGUAGES
PYTHON JAVASCRIPT WEB APPS
PHP SWIFT PERL BROWSER
JAVA C# SQL APPLICATIONS
C++ C OPERATING SYSTEM
ASSEMBLY BIOS
SILICON MACHINE CODE
JAVASCRIPT COMPILER
C++ COMPILER
C COMPILER
ASSEMBLY COMPILER

COMPILERS

SOFTWARE ENGINEERING
FORMAL METHODS
UNIT TESTING
VERSION CONTROL
OBJECT ORIENTED DESIGN

OPERATING SYSTEMS
iOS
macOS

NETWORKING
CONCURRENT/DISTRIBUTED/PARALLEL/SYSTEMS

DATA MANAGEMENT
DATABASES SQL DATACENTRES

PERFORMANCE
COMPUTER ANALYSIS
BENCHMARKING

APPLICATIONS

MACHINE LEARNING
SUPERVISED
UNSUPERISED
NEURAL NETWORK
CAT
REINFORCEMENT

OPTIMISATION
FINANCE
LEAGUE OF LEGENDS
AMAZON WAREHOUSE

BOOLEAN SATISFIABILITY
$\bar{x}_1$ OR x_2 OR $\bar{x}_3$ (SAT)
$\bar{x}_1$ OR $\bar{x}_2$ OR x_3
$\bar{x}_1$ OR $\bar{x}_2$ OR $\bar{x}_3$
$\bar{x}_1$ OR x_2 OR x_3

SUPER COMPUTING

COMPUTER GRAPHICS

COMPUTATIONAL SCIENCE
COMPUTATIONAL PHYSICS
NUMERICAL ANALYSIS
BIOINFORMATICS
COMPUTATIONAL CHEMISTRY

HACKING

ARTIFICIAL INTELLIGENCE
A.I.

ROBOTICS

COMPUTER VISION
FIND THE HUMANS

VIRTUAL REALITY

SIMULATION

BIG DATA

NATURAL LANGUAGE PROCESSING
CHATBOTS
-HEY
-ARE U A ROBOT?
HELLO THERE-
YES-
-WAIT, I MEAN NO-
-PROVE IT!
CALCULATING...-
I MADE YOU CAKE-

KNOWLEDGE REPRESENTATION
SCONES TEA FLOUR BUTTER
BIRTHDAY CAKE FOOD BACON
CELEBRATION PANCAKE BREAKFAST

TELEPRESCENCE

AUGMENTED REALITY
YOUTUBE
DOMAIN OF SCIENCE
MAP OF COMPUTER SCIENCE

HUMAN COMPUTER INTERACTION

IMAGE PROCESSING

INTERNET OF THINGS

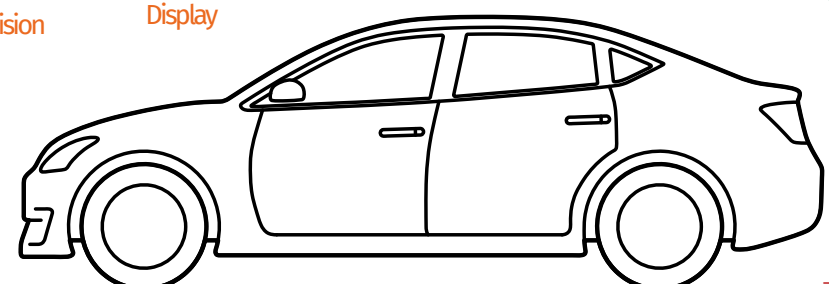
BY DOMINIC WALLIMAN ©2017

Electronique numérique

Domaines d'application

Electronique numérique

Exemple de voiture



Autopilot
Security
Basic
Cylinder De-activation
Automatic Breaking
Adaptive Cruise Control
Transmission Control
Electronic Throttle Control
Security System
Instrument Cluster
Distance Measurement
Lane Correction
Engine Control
Electric Power Steering
Battery Management
Electronic Valve Timing
Active Yaw Control
Electonic Stability Control
Head-Up Display
Night Vision
Anti-Theft System
Remote Keyless Entry
Airbag Deployment
Adaptive Front Lightning
Cabin Environment Controls
Driver Monitoring
Accident Recorder
Entertainment System
Parental Controls
Idle Stop/Start
Blindspot Detection
Lane Departure Warning
OBD
Antilock Braking
Regenerative Braking
Digital Turn Signals
Accidents
Active Suspension
Voice/Data Communication
Event Data Recorder
Hill-Hold Control
Tire Pressure Monitoring
Active Exhaust Noise Suppression
Auto-Dimming Mirror
Seat Position Control
Voice Control
Diagnostic
Parking System
Braking
Active Vibration Control
Interior Lightning
Comfort

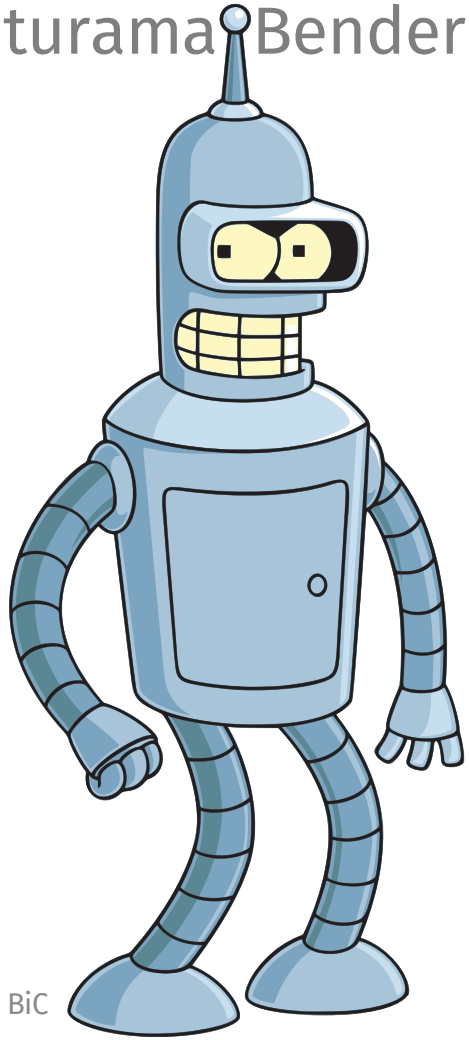
Electronique numérique

Ariane 5

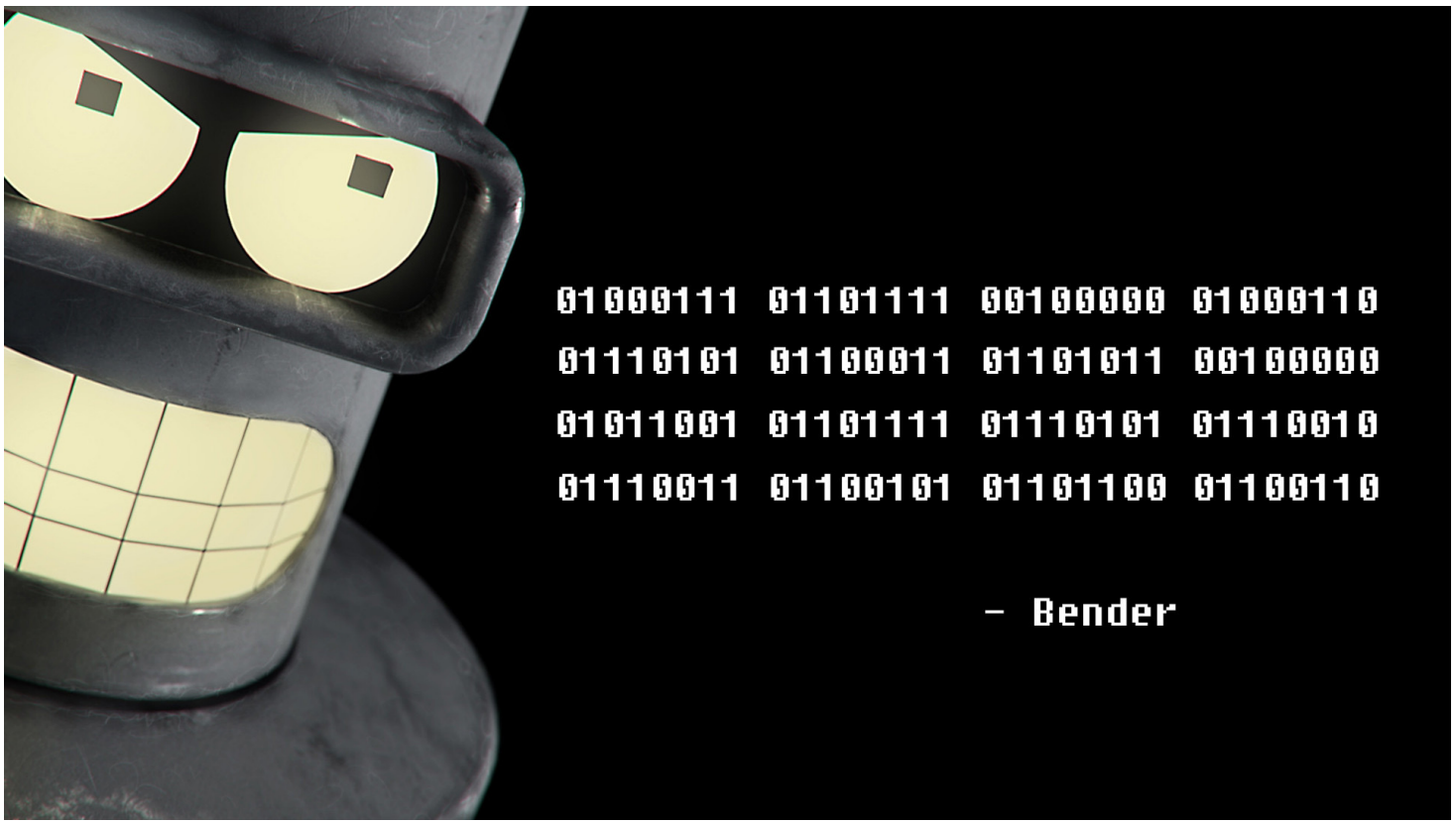
https://youtu.be/PK_yguLapgA

Electronique numérique

Futurama : Bender



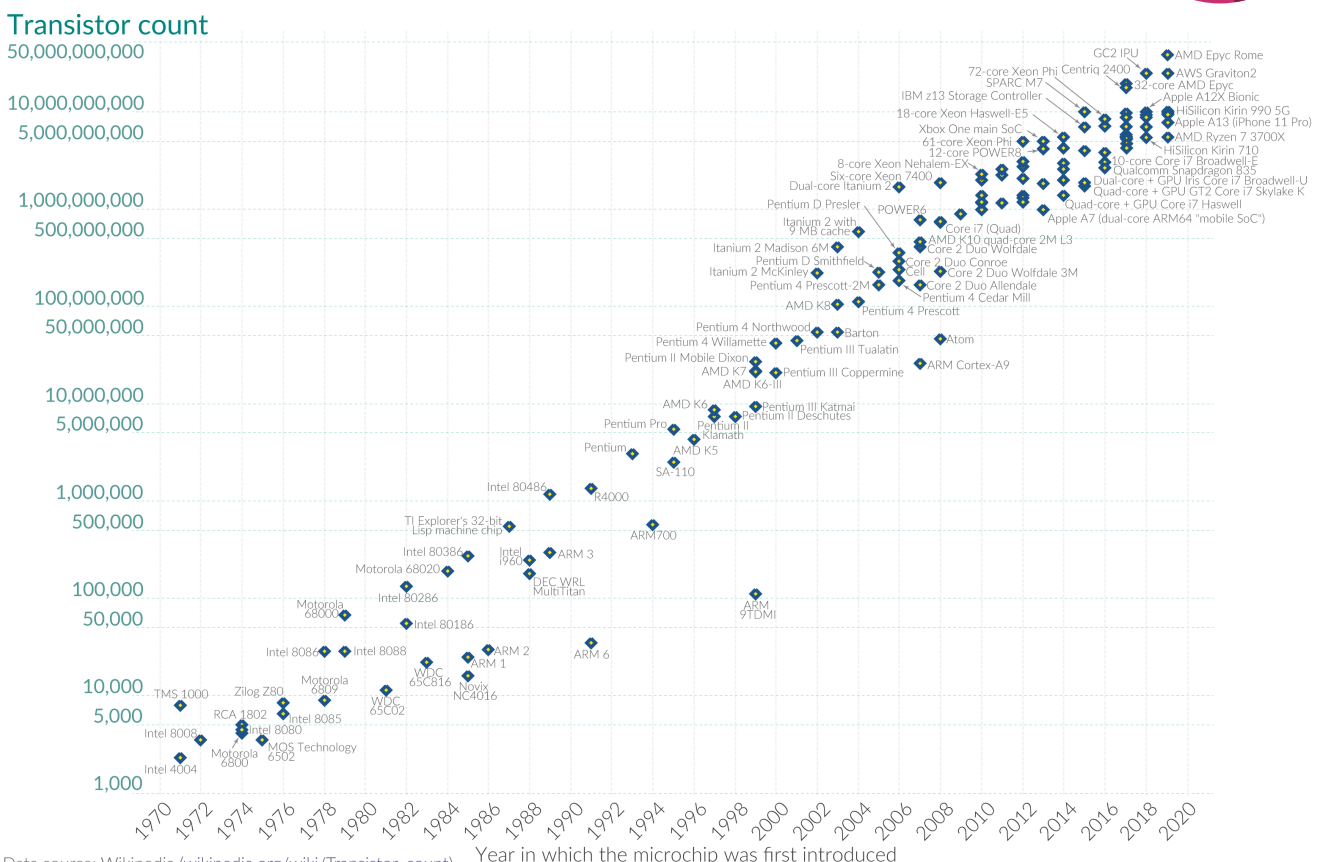
https://youtu.be/_4TPlwwHM8Q



Electronique numérique

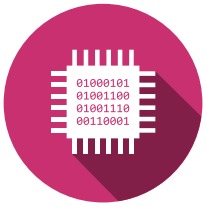
Moore’s Law

Number of transistors double every two years
- Gordon Moore -



Data source: Wikipedia (wikipedia.org/wiki/Transistor_count)
OurWorldinData.org – Research and data to make progress against the world’s largest problems.

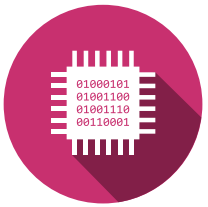
ISC Organisation



- Cours ($2^{Heures}/_{Semaine}$)
- Labore ($4\,^{Heures}/_{Semaine}$)
- Projet (Display $\approx 3 - 5\ Semaine$)
- Examen
  - Semaine 47 (17.11.2025 – 21.11.2025)

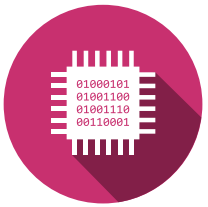
	Semestre automne (DiD)			*Semester printemps (CAr)*		
Evaluation	Exa 1	Project	Exa Sem	Labo	Project	Exa Sem
Exam Coefficient	0.5	0.5	1	0.5	0.5	1
Semester Coefficient	1		1	1		1
Module Coefficient	5/9			4/9		

Coopération Générale



- Présence au cours obligatoire
  - Seuls les professeurs peuvent donner une dispense
  - Si absentéisme grandissant ⇨ information au RF
- Prise de notes indispensable, notamment en cas d'exemples et exercices
- Exercices complémentaires à faire à la maison
  - Travail personnel indispensable
- Utilisation des téléphones mobiles
  - Interdit en classe ⇨ utiliser le temps des pauses
- Nourriture et boisson en classe
  - Interdit en classe

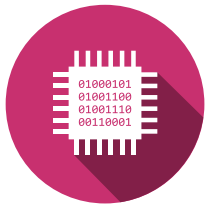
Appui



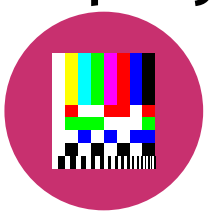
- Selon descriptif de module
- Obligatoire jusqu'au premier examen qui permet de connaître votre niveau
- Une excellente occasion de faire des exercices

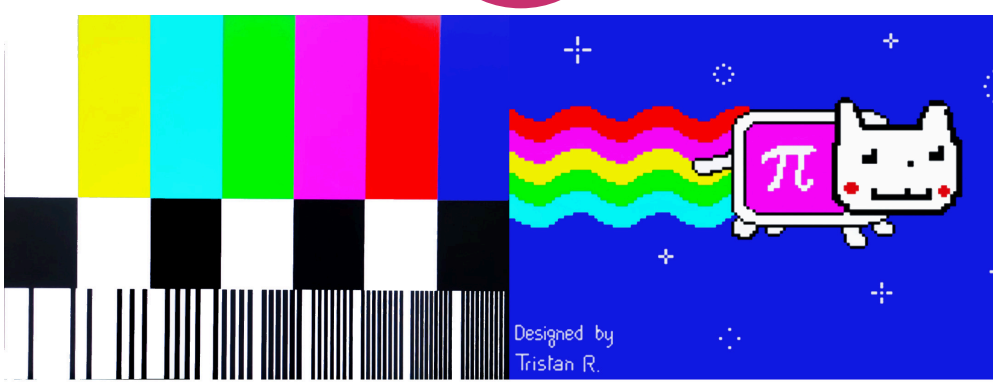
Projet de semestre

Informatique et systèmes de communication



Display





Organisation

Professeurs

Bianchi Christophe (BiC)
Bureau: ENP.23.N207
Email: christophe.bianchi@hevs.ch
Tel: +41 58 606 87 60

Andrea Guerrieri (GuA)
Bureau: ENG.23.N312
Email: andrea.guerrieri@hevs.ch
Tel: +41 58 606 93 55

Zahno Silvan (ZaS)
Bureau: ENG.23.N312
Email: silvan.zahno@hevs.ch
Tel: +41 58 606 88 07

Organisation
Collaborateurs

Alban Theytaz (ThA)
Bureau: ENG.23.N219
Email: alban.theytaz@hevs.ch
Tel: +41 58 606 85 85

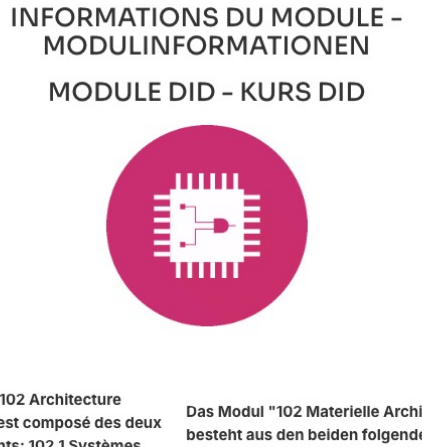
David Tagan (TaD)
Bureau: ENG.23.N219
Email: david.tagan@hevs.ch
Tel: +41 58 606 92 96

Rémy Borgeat (BoR)
Bureau: ENG.23.N313
Email: remy.borgeat@hevs.ch
Tel: +41 58 606 92 20

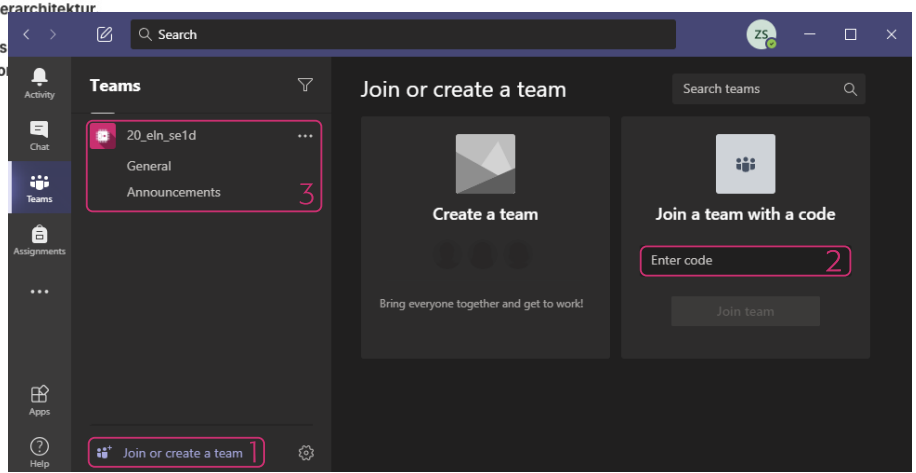
Serveurs et fichiers

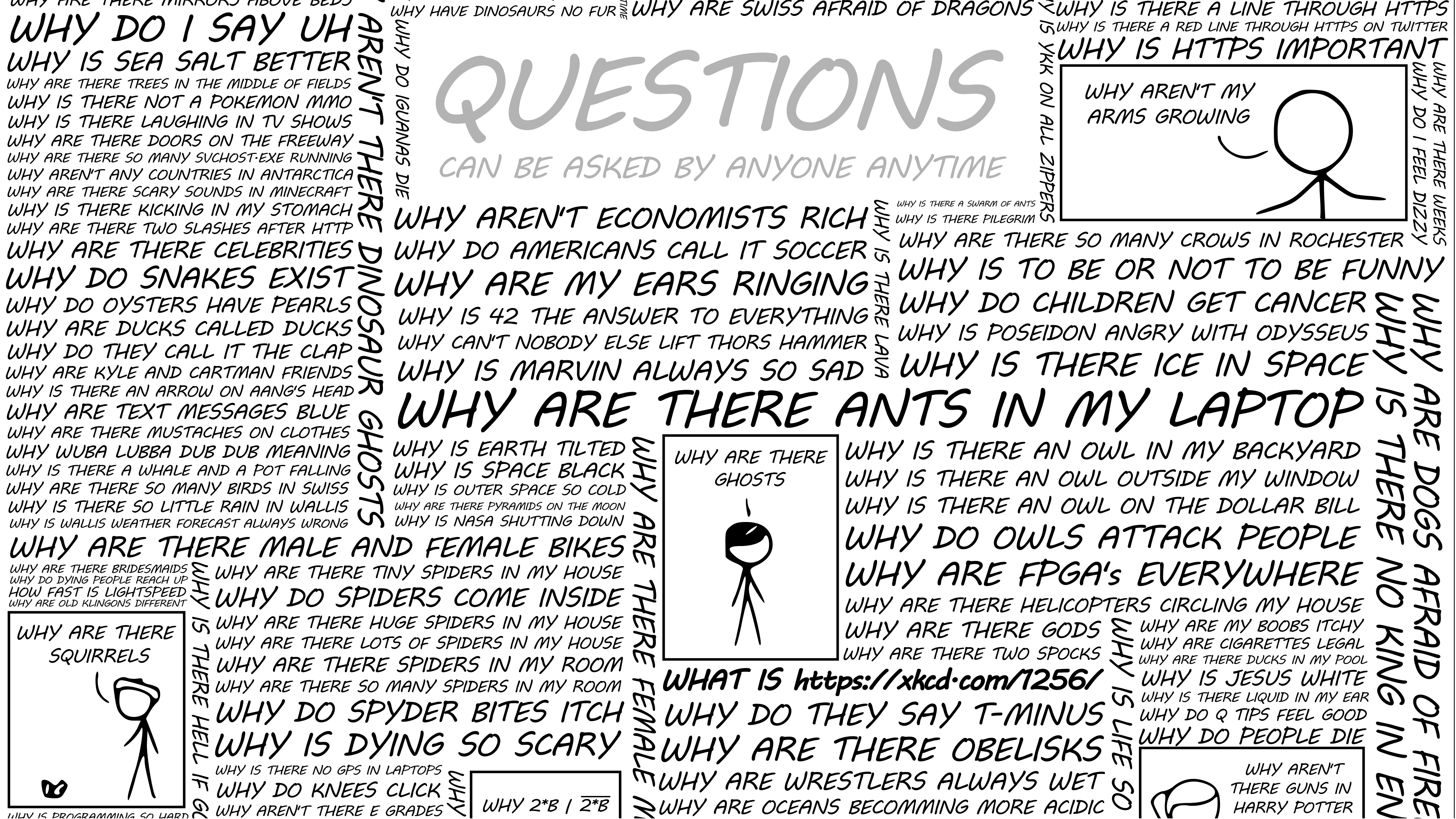
Informatique et systèmes de communication

- **Moodle ISC Learn**
  - 102.1 – Digital design
  - Password: *welcome*



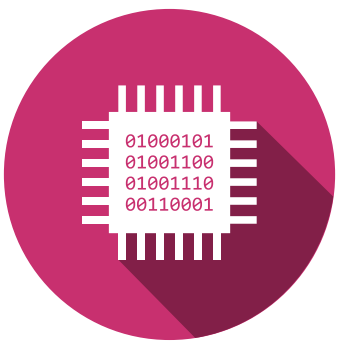
- **Microsoft Teams**
  - 25_ISC_Car
  - Access Code: **ia5sw6e**




WHY ARE THERE MIRRORS ABOVE BEDS
WHY DO I SAY UH
WHY IS SEA SALT BETTER
WHY ARE THERE TREES IN THE MIDDLE OF FIELDS
WHY IS THERE NOT A POKEMON MMO
WHY IS THERE LAUGHING IN TV SHOWS
WHY ARE THERE DOORS ON THE FREEWAY
WHY ARE THERE SO MANY SVCHOST.EXE RUNNING
WHY AREN'T ANY COUNTRIES IN ANTARCTICA
WHY ARE THERE SCARY SOUNDS IN MINECRAFT
WHY IS THERE KICKING IN MY STOMACH
WHY ARE THERE TWO SLASHES AFTER HTTP
WHY ARE THERE CELEBRITIES
WHY DO SNAKES EXIST
WHY DO OYSTERS HAVE PEARLS
WHY ARE DUCKS CALLED DUCKS
WHY DO THEY CALL IT THE CLAP
WHY ARE KYLE AND CARTMAN FRIENDS
WHY IS THERE AN ARROW ON AANG'S HEAD
WHY ARE TEXT MESSAGES BLUE
WHY ARE THERE MUSTACHES ON CLOTHES
WHY WUBA LUBBA DUB DUB MEANING
WHY IS THERE A WHALE AND A POT FALLING
WHY ARE THERE SO MANY BIRDS IN SWISS
WHY IS THERE SO LITTLE RAIN IN WALLIS
WHY IS WALLIS WEATHER FORECAST ALWAYS WRONG
WHY AREN'T THERE DINOSAUR GHOSTS
WHY HAVE DINOSAURS NO FUR
WHY DO IGUANAS DIE
QUESTIONS
CAN BE ASKED BY ANYONE ANYTIME
WHY ARE SWISS AFRAID OF DRAGONS
WHY IS YKK ON ALL ZIPPERS
WHY IS THERE A LINE THROUGH HTTPS
WHY IS THERE A RED LINE THROUGH HTTPS ON TWITTER
WHY IS HTTPS IMPORTANT
WHY AREN'T MY ARMS GROWING
WHY ARE THERE WEEKS
WHY DO I FEEL DIZZY
WHY AREN'T ECONOMISTS RICH
WHY DO AMERICANS CALL IT SOCCER
WHY ARE MY EARS RINGING
WHY IS 42 THE ANSWER TO EVERYTHING
WHY CAN'T NOBODY ELSE LIFT THORS HAMMER
WHY IS MARVIN ALWAYS SO SAD
WHY IS THERE LAVA
WHY IS THERE A SWARM OF ANTS
WHY IS THERE PILEGRIM
WHY ARE THERE SO MANY CROWS IN ROCHESTER
WHY IS TO BE OR NOT TO BE FUNNY
WHY DO CHILDREN GET CANCER
WHY IS POSEIDON ANGRY WITH ODYSSEUS
WHY IS THERE ICE IN SPACE
WHY ARE THERE ANTS IN MY LAPTOP
WHY IS EARTH TILTED
WHY IS SPACE BLACK
WHY IS OUTER SPACE SO COLD
WHY ARE THERE PYRAMIDS ON THE MOON
WHY IS NASA SHUTTING DOWN
WHY ARE THERE FEMALE
WHY ARE THERE GHOSTS
WHY IS THERE AN OWL IN MY BACKYARD
WHY IS THERE AN OWL OUTSIDE MY WINDOW
WHY IS THERE AN OWL ON THE DOLLAR BILL
WHY DO OWLS ATTACK PEOPLE
WHY ARE FPGA's EVERYWHERE
WHY ARE THERE HELICOPTERS CIRCLING MY HOUSE
WHY IS THERE NO KING IN EN
WHY ARE DOGS AFRAID OF FIRE
WHY ARE THERE MALE AND FEMALE BIKES
WHY ARE THERE BRIDESMAIDS
WHY DO DYING PEOPLE REACH UP
HOW FAST IS LIGHTSPEED
WHY ARE OLD KLINGONS DIFFERENT
WHY ARE THERE SQUIRRELS
WHY IS THERE HELL IF
WHY ARE THERE TINY SPIDERS IN MY HOUSE
WHY DO SPIDERS COME INSIDE
WHY ARE THERE HUGE SPIDERS IN MY HOUSE
WHY ARE THERE LOTS OF SPIDERS IN MY HOUSE
WHY ARE THERE SPIDERS IN MY ROOM
WHY ARE THERE SO MANY SPIDERS IN MY ROOM
WHY DO SPYDER BITES ITCH
WHY IS DYING SO SCARY
WHY IS THERE NO GPS IN LAPTOPS
WHY DO KNEES CLICK
WHY AREN'T THERE E GRADES
WHY IS PROGRAMMING SO HARD
WHY
WHY 2*B | $\overline{2*B}$
WHAT IS https://xkcd.com/1256/
WHY DO THEY SAY T-MINUS
WHY ARE THERE OBELISKS
WHY ARE WRESTLERS ALWAYS WET
WHY ARE OCEANS BECOMMING MORE ACIDIC
WHY ARE THERE GODS
WHY ARE THERE TWO SPOCKS
WHY IS LIFE SO
WHY ARE MY BOOBS ITCHY
WHY ARE CIGARETTES LEGAL
WHY ARE THERE DUCKS IN MY POOL
WHY IS JESUS WHITE
WHY IS THERE LIQUID IN MY EAR
WHY DO Q TIPS FEEL GOOD
WHY DO PEOPLE DIE
WHY AREN'T THERE GUNS IN HARRY POTTER

Hes·so VALAIS WALLIS

Haute Ecole d'Ingénierie
Hochschule für Ingenieurwissenschaften



Silvan Zahno silvan.zahno@hevs.ch
Christophe Bianchi christophe.bianchi@hevs.ch
François Corthay francois.corthay@hevs.ch