ANNEX A · INFORMATION & ARCHITECTURE

NAME _____ DATE _____

TASK 0 **Warm-up — binary and hex**

Alone. Weights of a byte: `128 64 32 16 8 4 2 1`. Hex digits: `0-9 A=10 B=11 C=12 D=13 E=14 F=15`.

(a) `0110 0100` → decimal _____ (b) 200 → binary _____ (c) `1010 1111` → hex _____

(d) A4 → binary _____ (e) 2A → decimal _____ (f) `#FF0000` → R ____ G ____ B ____

☐ **Done when:** you have six answers and you checked them against the board.

TASK 1 **Twenty questions (pairs)**

1 A thinks of a number from 1 to 8. B finds it with yes/no questions, cutting the options in half each time.
Questions needed: _____

2 A writes a number from 1 to 1,000,000 here and hides it: _____
B asks only yes/no questions ("Is it greater than 500,000?") and makes a mark for each one.
B's marks: _____ Total: _____

3 After the class counts: cutting in half every time, you never need more than _____ questions, because 2 to the power of _____ is 1,048,576. Each yes/no answer is worth one _____.

☐ **Done when:** B found the number and you counted the questions.

TASK 2 **Play the receiver (pairs)**

The code: **A** = `0` **N** = `10` **B** = `11`. There are no spaces between the letters. Decode this message:

```
1 0 0 1 1 0 0
```

Letters: _____

Bits used: _____ The same letters in ASCII (8 bits each): _____ bits.

How did you know where each letter ends? _____

☐ **Done when:** you have five letters and both bit counts.

TASK 3 **Which file gets smaller?**

Open a terminal: **Ctrl + Alt + T**. You will make two files of the same size, one that repeats a word and one of random bytes, and compress both. **Before you type**, tick your prediction: the smaller ZIP will be ☐ the repetitive one ☐ the random one ☐ the same.

```
yes hola | head -c 10M > repetitive.txt
head -c 10M /dev/urandom > random.bin
zip rep.zip repetitive.txt
zip rnd.zip random.bin
ls -lh repetitive.txt random.bin rep.zip rnd.zip
```

Sizes: `repetitive.txt` _____ `random.bin` _____ `rep.zip` _____ `rnd.zip` _____

Why? Use the word surprise or predict: _____

Clean up: `rm repetitive.txt random.bin rep.zip rnd.zip`

☐ **Done when:** you wrote four sizes and one sentence that explains them.

TASK 4 **A program is just bytes**

The command `ls` is a program. Look at the first bytes of its file:

```
od -A x -t x1z /usr/bin/ls | head -3
```

First four bytes of the first line: ____ ____ ____ ____ The three letters at the end of that line: _____

☐ **Done when:** you copied four bytes in hex and three letters.

TASK 5 **Find the diagram inside your PC**

Type each command and write what you read. To stop `watch`, press **Ctrl + C**.

Box	Command	What I read
CPU	`LC_ALL=C lscpu | grep -E "Model name|^CPU\(s\):"`	Name: CPU(s):
CPU clock	`watch -n1 "grep MHz /proc/cpuinfo"`	Lowest and highest MHz you see:
Memory	`free -h`	Row Mem, total: available:
Disk	`lsblk -d -o NAME,SIZE,ROTA`	SIZE: ROTA:
Bus + I/O	`lspci`	One device in the list:
I/O	`lsusb`	One device in the list:

Which is bigger, the memory or the disk? _____ Why is that fine? _____

☐ **Done when:** every row has an answer.

TASK 6 **Fetch → decode → execute**

Six classmates act as the computer. Fill in one row each time the Control Unit finishes an instruction.

Instruction	The Control Unit says…	Who does the work?	Register A now
1. LOAD 5			
2. ADD 3			
3. STORE result			
4. PRINT result			

Who walked the most? _____ Then run it yourself on the site: Computer architecture → **Next**.

☐ **Done when:** the simulator on the site shows the same as your four rows.

TASK 7 **Harvard inside your Von Neumann**

```
lscpu --caches
grep -o -w nx /proc/cpuinfo | head -1
```

TYPE of L1d: _____ L1i: _____ L2: _____

It prints: _____

Harvard or modified Harvard? Your laptop _____ your phone _____ an Arduino Uno _____

☐ **Done when:** you can say which cache level is split in two, and why that is "Harvard".

EXIT TICKET **Alone. One answer each, two in question 5.**

1. For Shannon, which carries more information: "the sun rose today" or "tomorrow's exam is cancelled"?

○ a) The sunrise: it is a bigger event ○ b) The exam news: it has more words
○ c) The exam news: it was surprising ○ d) Neither: both carry the same

2. Why can a Huffman code compress text and still be decoded?

○ a) Short codes for frequent symbols; no code starts another ○ b) Unknown symbols are removed from the text
○ c) A separator is added between every two codes ○ d) Frequent symbols get long codes, easier to see

3. What was new in the stored-program concept?

○ a) Programs became faster after it ○ b) Program and data were kept in separate places
○ c) The program is stored in memory, like any data ○ d) The machine could only run one program

4. Which part of the CPU actually adds two numbers?

○ a) The Control Unit ○ b) The ALU
○ c) The registers ○ d) The bus

5. Pick the **two** that are true about the CPU of a current laptop.

○ a) Programs and data share the same RAM ○ b) Programs and data live in separate RAM modules
○ c) It is a pure Harvard machine ○ d) Its L1 cache is split into instructions and data