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Prénom .....

Nom .....

Promotion .....

Groupe .....

Promotion **L3 INT**

Module **Architecture des ordinateurs**

Code cours **TI6 06I**

DE - 1h45 min

**20/05/2019 10H – 11H45**

Sujet proposé par : **DAMESTOY Jean-Paul**

Calculatrice autorisée : ☒ **OUI** ☐ **NON**

Documents autorisés : ☐ **OUI** ☒ **NON** Type de documents :

Ordinateur portable autorisé : ☐ **OUI** ☒ **NON**

Internet : ☐ **OUI** ☒ **NON**

Traducteur électronique, dictionnaire : ☐ **OUI** ☒ **NON**

### Consigne :

Merci de restituer uniquement : **les copies quadrillées**

#### Rappel :

- Tous les appareils électroniques (téléphones portables, ordinateurs, tablettes, montres connectées ...) doivent être éteints et rangés.
- Il est interdit de communiquer.
- Toute fraude ou tentative de fraude fera l'objet d'un rapport de la part du surveillant et sera sanctionnée par la note zéro, assortie d'une convocation devant le conseil de discipline. Aucune contestation ne sera possible. Tous les documents et supports utilisés frauduleusement devront être remis au surveillant.
- Aucune sortie de la salle d'examen ne sera autorisée avant la moitié de la durée de l'épreuve.

**Exercise 1: Representation of integers (3 points)**

1. Express the decimal numbers 94, 141, 163 et 197 in base 2, 8 et 16.
2. Give on 8 bits the representations "sign and absolute value" and complement to 2 of the decimal numbers 45, 73, 84, -99, -102 et -118.

**Exercise 2: Transferring data (2 points)**

A RAM memory, connected to the processor, has a cycle time of 20 ns for the first access and 10 ns for the next three accesses which are accelerated. Each access fetches 8 bytes.

What is the bandwidth of the information transfer between the memory and the processor?

**Exercise 3: Calculate the performance of a hard disk drive (4 points)**

A hard disk drive has the following characteristics:

- Access time of 10 ms;
  - Rotational speed of 6,000 rpm;
  - Transfer rate of 20 MB/s.
1. A 20 MB file is transferred to memory with data divided into 1,000 groups of 20 KB. These groups are located at different places on the disk, requiring one access for each one.  
What is the total transfer time and what is the resulting bandwidth?
  2. Following a reorganization of the information on the disk, the 20 MB file is now stored in one hundred 200 KB groups.  
What is the total transfer time and what is the resulting bandwidth?

#### **Exercise 4: little-endian and big-endian standards (6 points)**

Let's consider two computers with 32-bit memory words. One adopts the big-endian representation, the other the little-endian representation.

1. Remind the byte organization in a memory word with each of these two representations.
2. It is assumed that these machines store the following information for a database record:
  - Name: « Luc Duval », which is a string of characters, each character occupying one byte in memory;
  - Age: 31, which is an integer stored in a memory word;
  - Service number: 260, which is also an integer (for information  $260 = 1 \times 256 + 4$ ) stored in a memory word.

Give the representations in memory of these data for each of the two machines (for information, 20 bytes, or 5 memory words, are required).

3. This data is transferred from the big-endian machine to the little-endian machine. If this transfer is done byte by byte (from byte 0 to byte 19), how are the values received by the little-endian machine interpreted?

#### **Exercise 5: Capacity of a floppy disk (3 points)**

A high-density diskette has the following characteristics:

- linear density of 686.38 bits per millimetre for the internal track,
  - radius of the internal track of 24.6875 mm,
  - number of faces: 2,
  - number of tracks per side: 80,
  - number of sectors per track: 18,
  - number of data bytes per sector: 512.
1. Calculate the number of bits on the internal track. Knowing that all tracks have the same number of bits, determine the total capacity of the floppy disk.
  2. What is the useful capacity of the floppy disk?

### **Exercise 6: Arbitration of interruptions (2 points)**

The following four types of external or internal interruptions are considered:

- external interruption from a device;
- attempt to execute an illegal investigation;
- thermal interruption indicating an overheating of the processor;
- system call.

Prioritize these interruptions (which interruption can interrupt the processing of another with a lower priority?).