



University of Lleida

Master's Degree in Informatics Engineering

Higher Polytechnic School

Questions Chapter 1

High Performance Computing

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1. Which is the most significant contribution of the Babbage machine proposed in the S. XIX? In your opinion, why was the machine of Babbage never built?

It was the first machine that decreased the calculation errors and increased the calculation precision and accuracy.

First of all, the Babbage machine, also called The difference engine based on Newton's method of divided differences, required its parts to be extremely precise. Thus, the era technology was not able to build these parts as required, because of the expensive cost so the British government decided not to finance the project anymore.

2. As you known, history of computing epoch can be divided in six different periods. Each of one is triggered by a specific technological development. According to this, describe the technological development, which is the origin of each new period.

- **1st gen:** quick development of electronics resulted in the first electro-mechanical and electronic machines to compute.
- **2nd gen:** transistor is born.
- **3rd gen:** combining transistors implied the built of the first integrated circuits or chips.
- **4th gen:** first microprocessors built, the ones improved the density of integration by its predecessors the integrated circuits.
- **5th gen:** personal computers arrived.
- **6th gen:** supercomputing.

3. Which is the oldest technological company in the world?

IBM is the oldest technological company.

4. Which was the first electronic computer built in the world?

Eniac was the first electronic computer.

5. What invention allowed evolution from the electro-mechanical computers to the electronic computers?

The development of electronic: diodes, vacuum tubes, cathodics beams +/- Switches and relay logic - theoretical proposal of Shannon.

6. Which is the most significant contribution of the EDVAC computer?

The first machine with the program stored inside the computer and the first binary computer.

7. During the second generation, why were some of the most significant technological start-ups built in Palo-Alto?

Because it is located closely to Stanford University, one of the predecessor of ARPANET, predecessor of the Internet and one of the best engineering and It universities of the US, therefore a great place to find employees. Being the birthplace of many disruptive technologies such as silicon-based integrated circuit and Fairchild's Planar Technical, which allows to build cheaper transistors.

8. Which is the most significant contribution of the Cray company?

The creation of the first supercomputer and the first computer to use RAM (Random Access Memory) and RISK Architecture.

9. What are the most significant advantages of the MOS transistor in relation to the bipolar transistor?

It improves the density of integration.

10. Experts say than Moore Law will reach the saturation during this decade. Which is the basis of this statement?

The stagnation of Moore's Law is a consequence of the physical limit of current technology. Increasing transistor density will increase the heat generated in the same area, therefore it is not possible to extract the heat fast enough without the risk of overheating and damaging the microprocessor.

11. Which are main characteristics of the 4004 microprocessor developed by Intel during the fourth generation?

Is a microprocessor designed at Intel, which had a CPU of 4 bits and 2300 transistors.

12. What is the best-selling PC ever?

Commodore 64 (C64), released in January 1982 with 17 million units sold at \$595 in the US. Packing an enormous 1MHz CPU and of course 64 KB of RAM.

13. During the fifth generation the challenge is not only to integrate more transistors/chips, but to make them work more efficiently. Enumerate three examples of inventions introduced by manufacturers of personal computers to achieve this aim.

- **1:** Modular desing.
- **2:** Operation System (MSDOS) by Microsoft.

14. How many FLOPS are 1 GFLOP, 1 TFLOP, 1 TPFLOP and 1 EFLOP

1 GFLOP	109 Flops
1 TFLOP	1012 Flops
1 PFLOP	1015 Flops
1 EFLOP	1018 Flops

Table 1: Multiple Flops measures

15. How is the supercomputer performance measured?

The performance of a supercomputer is commonly measured in floating-point operations per second (FLOPS) instead of million instructions per second (MIPS).

16. Which year was the Petaflop barrier broken? Which did the supercomputer break this barrier?

2008 by Roadrunner.

17. Which is the most significant technological contribution of the Thiane super-computer, top one in the list top500 of 2010?

The first one who combined GPUs to normal Processors.

18. How does a GPU work?

The GPU executes a specific simple instruction in parallel.

19. Which is the main novelty of the list top500 of 2012?

Energy Consumption begins to be a challenge.

20. Which is the best supercomputer taking into account the balance between performance and consumption?

According to the list of “TOP 500 -November 2020” is IBM POWER9(22C,307GHz) NVIDIA Volta GV (80C), Dual-Rail Mellanox EDR Infiniband.

21. In the last ranking of the 500, which is the most used model of GPU, processor and network?

- **GPU:** NVIDIA TESLA V100
- **GPU FAMILY:** NVIDIA VOLTA
- **CPU:** Xeon Gold
- **NETWORK:** 10G Ethernet

22. What do you expect to learn in the subject of High Performance Computing?

Understanding High-Performance Computing in Distributed Systems (Clusters), and how to run our multi-process programs efficiently there, via its shuttle config SGE scripts.