Solution DW N° 04

Exercise 01:

A/

RAM: Random Access Memory, also known as main memory, allows storing data of running programs on a computer. It is sold in the form of modules containing up to 4GB of data or more.

RAM is read/write but volatile, whereas ROM is read-only and non-volatile. ROM is generally used for BIOS data for booting the machine.

B/

a- RAM is volatile memory, meaning it is erased when the computer is turned off!
b- This is why it operates in conjunction with faster memory, the RAM.

C/

220.0 MB/s = 220.0 x 8 Mbits/s > 472.0 Mbits.

D/

a. No, because 128MB + 256MB + 512MB = 996MB, and with these proposed modules and three memory slots, we cannot reach 1GB.
b. The correct combination is: 512MB + 256MB + 256MB = 1024MB = 1GB.

Exercise 02:

Main memory is volatile as long as there is power (i.e., it's being supplied), the information is present.
The unit of measurement for information is the byte.
This means that the word size is equal to 32 bits or 4 bytes.
Reminder:
We have:

a. 1 Byte = 8 bits = 2^3 bits
b. 1 KB = 1024 Bytes = 2^10 Bytes;
c. 1 MB = 1024 * 1024 bytes = 2^20 Bytes;
d. 1 GB = 1024 * 1024 * 1024 bytes = 2^30 Bytes;

Other units:

One Petabyte (PB) contains 1024 Terabytes (TB) (= 2^50 bytes). One Exabyte (EB) contains 1024 PB (= 2^60 bytes). One Zettabyte (ZB) contains 1024 EB (= 2^70 bytes). One Yottabyte (YB) contains 1024 ZB (= 2^80 bytes).

So:

256 GB = 2^8 * 2^10 MB = 2^18 MB = 2^18 * 2^10 KB = 2^28 KB; 64 GB = 2^6 * 2^20 KB = 2^26 KB; 4096 GB = 4096 / 1024 TB = 4 TB; 2048 * 2^80 PB = 2 * 2^10 * 2^70 PB = 2^11 PB = 2^1 EB = 2 EB 1024 * 2^120 GB = 2^10 * 2^20 GB = 2^30 GB.

Exercise 03:

Each word occupies 8 bytes. Thus, with 500 MB, it can store 500 * 1024 * 1024 / 8 = 65,536,000 words. It can store 500 MB / 1 KB = 500 thousand pages. It can store 500 photos.

Main memory operates at a higher speed than auxiliary memory. However, its capacity is more limited. Thus, main memory is primarily used to store information to be processed. Auxiliary memory has a greater capacity and can be used as a large mass storage support. Additionally, since the content of main memory is erased when the computer is turned off, auxiliary memory is needed to retain information permanently.

Exercise 04:

A/ A - 2, 6; B - 5, 7, 3; C - 1, 5;

For the first case, we have:
1 byte = 8 bits
Transfer rate = bus width / 8 x bus frequency
For the first case:
Bus width (bits) = 32 Bus frequency (MHz) = 66 Transfer rate (MB/s) = (32 / 8) x 66 = 264

B/

Examples of memory buses (comparing memory buses): calculate the following transfer rates:

	EDO	SDRAM	SDRAM PC100	SDRAM PC2100(DDR)
Bus width (bits)	32	64	64	64
Bus frequency (MHz)	66	66	100	133
Transfer rate (MB/s)	264	528	800	1064

Peripheral buses: calculate the following transfer rates:

	ISA	EISA	PCI	AGP	AGP 4x
Bus width (bits)	16	32	32	32	32
Bus frequency (MHz)	8.33	8.33	33.33	66.66	66.66
Transfer rate (MB/s)	16,66	33,33	133,33	266,66	1066,66

Exercise 05

A- The throughput = 533 x 2 x 8 = 8528

B- Choose the correct answer (justify your choice):

1/ What is the size of a memory with 15 address inputs and 8 bits of data?

a) 32 Kilobytes (The number of addressable cells with n address lines is 2^n, so: 2^15 = 32 Kilobytes).
b) 64 Kilobytes
c) 16 Kilobytes

2/ What is the capacity of a memory chip with a 14-bit address bus and an 8-bit data bus?

a) 8 Kilobytes
b) 16 Kilobytes (The number of addressable cells with 14 address lines is 2^14, so: 2^14 = 16 Kilobytes).
c) 32 Kilobytes

3/ How many 10 MB files can be stored in a 1 GB space?
1GBytes
a) Around 1000
b) Around 100 **(the number of files = 1024MB / 10MB = 102)**
c) Around 10

Exercise 06:

- ✓ **Instruction Register** (RI), containing the current instruction being processed; RI = 32 bits
- ✓ **Program Counter (OC or PC),** containing the address of the next instruction to be processed; PC = 16 bits
- ✓ **MAR** (Memory Address Register): this register stores the address of the word to be read or written; RAM = 16 bits
- ✓ **MIR** (Memory Information Register): stores the information read from the memory or the information to be written into the memory. MIR = 32 bits

1. Bus sizes:
Address bus size = 16 bits = k
Data bus size = 32 bits = n

3. Memory size = (number of memory words) x (n bits) = 2^K x n = 2^{16}x(32 bits) = 2^{21} bits= 2^{18} Bytes
=0,25 MBytes

- If K =8 Bits Then **Memory size** = 2^K x (n bits) =2^8 x(32 bits) =2^{10} Bytes = 1 Kbytes .

4. The number of memory words that can be stored in memory = 2^K =2^{16} memory words

5. The throughput offered by the data bus is: Throughput = Transfer rate = (bus width / 8) x bus frequency = (32 / 8) x 200 = 800 MB/s.