S2 – Examination 4
Computer Architecture

Duration: 1 hr 30 min

Answer on the answer sheet only.
Do not show any calculation unless you are explicitly asked.
Do not use a pencil or red ink.

Exercise 1 (7 points)

Answer the questions on the answer sheet.

Exercise 2 (4 points)

We want to build a 128-Mib ROM device (labelled ***M***) from several 8-Mib ROM devices (labelled ***m***). The ***M*** device has a 16-bit data bus. The ***m*** devices have an 8-bit data bus. Answer the questions on the answer sheet.

Exercise 3 (4 points)

A microprocessor system includes a ROM device, a RAM device and two peripheral devices (**P1** and **P2**). The capacities (in bits) of these devices are 8 Mib, 32 Kib, 2 Kib and 1 Kib respectively. The microprocessor has a 24-bit address bus (the address bits are numbered from *A0* to *A23* and *A0* is the least significant bit). All the components have an 8-bit data bus. The ROM must be located in the lowest part of the memory space, followed by the RAM, **P1** and **P2**.

1. Calculate the size of the address buses for each device.

For the following questions, the linear-decoding technique must be used.

2. Which address bits are required to select the devices?
3. Write down an expression for each output of the address decoder. Take the *AS* signal (Address Strobe) into account.
4. Give the lowest and highest addresses for each device. (Use the 6-digit hexadecimal representation.)

Exercise 4 (5 points)

A microprocessor system includes a ROM device, a RAM device and two peripheral devices (**P1** and **P2**). The capacities (in bytes) of these devices are 128 KiB, 16 KiB, 4 KiB and 1024 bytes respectively. The microprocessor has a 20-bit address bus (the address bits are numbered from *A0* to *A19* and *A0* is the least significant bit). All the components have an 8-bit data bus. The ROM must be located in the lowest part of the memory space, followed by the RAM, **P1** and **P2**.

1. Calculate the size of the address buses for each device.
2. Can we use the linear address decoding?

For the following questions, the block-decoding technique must be used with as few blocks as possible.

3. Which address bits are required to select the devices?
4. Write down an expression for each output of the address decoder. Take the *AS* signal (Address Strobe) into account.
5. Give the lowest and highest addresses for each device. (Use the 5-digit hexadecimal representation.)
6. Work out the number of images for each device.