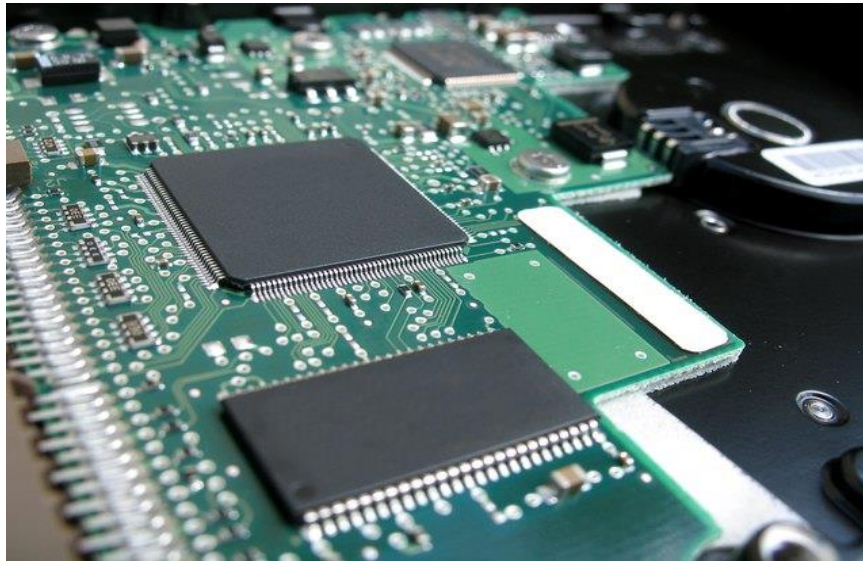Lecture 29

Microprocessors

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Programmed input/output Port

- 8086 I/O Ports, important points to be Considered for 8086 interface to memory, I/O and 8086-based microcomputer. Devices with 8-bit I/O ports can be connected to either the upper or the lower half of the data bus. If the I/O port chip is connected to the lower half of the 8086 data lines (AD0- AD7), the port addresses will be even ($A_0 = 0$). On the other hand, the port addresses will be odd (A0 = 1) if the I/O port chip is connected to the upper half of the 8086 data lines (AD8-AD $_{15}$). A0 will always be 1 or 0 for the partitioned I/O chip. Therefore, A_0 cannot be used as an address input to select registers within a particular I/O chip. If two chips are connected to the lower and upper halves of the 8086 address bus that differ only in A0 (consecutive odd and even addresses), A0 and BHE must be used as conditions of chip select decoding to avoid a write to one I/O chip from erroneously performing a write to the other.

يمكن توصيل الأجهزة ذات منافذ الإدخال / الإخراج 8 بت إما بالنصف العلوي أو السفلي من ناقل البيانات. إذا كانت شريحة منفذ الإدخال / الإخراج متصلة بالنصف السفلي من خطوط البيانات (AD0- AD7) ، فستكون عناوين المنفذ زوجية (A0 = 0) .

من ناحية أخرى ، ستكون عناوين المنافذ فردية (A0 = 1) إذا كانت شريحة منفذ الإدخال / الإخراج متصلة بالنصف العلوي من خطوط البيانات 8086. (AD8-AD 15) ستكون A0 دائمًا 1 أو 0 لشريحة الإدخال / الإخراج المقسمة. لذلك ، لا يمكن استخدام A0كمدخل عنوان لتحديد السجلات داخل شريحة إدخال / إخراج معينة. إذا تم توصيل شريحتين بالنصفين السفلي والعلوي من ناقل العنوان 8086 اللذين يختلفان فقط في A0 (عناوين فردية وزوجية متتالية) ، يجب استخدام A0 و BHE كشرط لفك تشفير الشريحة لتجنب الكتابة إلى واحد O / I رقاقة من أداء الكتابة بشكل خاطئ للآخر.

The 8086 uses either standard I/O or memory-mapped I/O. The standard I/O uses the instructions IN and OUT, and is able to provide up to 64K bytes of I/O locations. The standard I/O can transfer either 8-bit data or 16-bit data to or from a peripheral device. The 64-Kbyte I/O locations can then be configured as 64K 8-bit ports or 32K 16-bit ports. All I/O transfers between the 8086 and peripheral devices take place via AL for 8-bit ports (AH is not involved) and AX for 16-bit ports.

يستخدم 8086 إما الإدخال / الإخراج القياسي أو الإدخال / الإخراج المعين للذاكرة. يستخدم O / I القياسي الإرشادات IN and OUT ، وهو قادر على توفير ما يصل إلى 64 كيلو بايت من مواقع الإدخال / الإخراج. يمكن لـ O / I القياسي نقل بيانات 8 بت أو بيانات 16 بت إلى أو من جهاز طرفي. يمكن بعد ذلك تكوين مواقع الإدخال / الإخراج 64 كيلو بايت كمنافذ 64 كيلو بايت 8 بت أو 32 كيلو بايت 16 بت. تتم جميع عمليات نقل الإدخال / الإخراج بين 8086 والأجهزة الطرفية عبر AL لمنافذ 8 بت (AH غير متضمنة) و AX لمنافذ 16 بت.

Data transfer using the memory-mapped I/O is accomplished by using memory-oriented instructions such as MOV reg8 or reg. 16, [BX] and MOV [BX], reg. 8 or reg. 16 for inputting and outputting 8- or 16-bit data from or to an 8-bit register or a 16-bit register addressed by the 20-bit memory-mapped port location computed from DS and BX.

Note that the indirect I/O transfer method is desirable for service routines that handle more than one device such as multiple printers by allowing the desired device to be passed to the procedure as a parameter.

يتم تنفيذ نقل البيانات باستخدام الإدخال / الإخراج المعين للذاكرة باستخدام الإرشادات الموجهة للذاكرة مثل MOV reg8أو reg. 16 ، [BX] وMOV [BX] ، 8 .regأو 16 .reg للإدخال والإخراج 8 أو 16

بت البيانات من أو إلى سجل 8 بت أو سجل 16 بت يتم معالجته بواسطة موقع المنفذ المعين للذاكرة 20 بت
المحسوب من DS وBX.

a) Eight-Bit I/O Ports

Devices with 8-bit I/O ports can be connected to either the upper or lower half of the data bus. Bus loading is distributed by connecting an equal number of devices to the upper and lower halves of the data bus. If the I/O port chip is connected to the 8086 lower half of the data lines (Ado-AD7), the port address will be even (A0=0). On the other hand, the port addresses will be odd (A0=1) if the I/O port chip is connected to the upper half of the 8086 data lines (AD8-AD15). A0 will always be one or zero for a partitioned I/O chip.

b) Sixteen-Bit I/O Ports

For efficient bus utilization and simplicity of I/O chip selection sixteen bit I/O ports should be assigned even addresses.

Both A0 and BHE should be the chip select conditions to ensure that the I/O is selected only for word operations. the 8086 will output low on both A0 and BHE when it executes a 16-bit I/O instruction with an even port address such as IN AX,0006H. This instruction input the 16-bit contents of ports 0006H and 0007H in AX.

Note: PORT is a constant ranging from 0 to 255

Flags: No flags are affected

- **<u>Comparison between Memory Mapping & I/O Mapping for interfacing I/O devices:</u>**

Memory Mapping	IO mapping
1. 20-bit addresses are provided for IO devices.	1. 8-bit or 16-bit address are provided for IO devices
2. The IO ports or peripherals can be treated like memory locations and so all instructions related to memory can be used for data transfer.	2. Only IN and OUT instructions can be used for data transfer between IO device and the processor.
3. In memory mapped ports, the data can be moved from any register to port and vice versa	3. In IO mapped ports, the data transfer can take only between the accumulator and the ports
4. When memory mapping is used for IO devices, the full memory address space cannot be used for addressing memory.	4. When IO mapping is used for IO devices, then the full address space can be used for addressing memory.