10.1 FUNCTIONS OF INPUT AND OUTPUT DEVICES

- The main function of an input device is to ____________________________;
- The main function of an output device is to ____________________________;

10.2 COMMON INPUT DEVICES

10.2.1 ________________
- when a key is depressed, the ASCII code of that character will be encoded and set to the CPU for processing

10.2.2 _____________ and _______________
- a video pointing device
- it has a small bearing (ball) on the bottom and one or more buttons on the top (opposite for trackball)
- generates electrical signals when the movement of the bearing is detected
- typical application:
  ◊ select a particular item on a menu displayed on a menu (e.g. Windows applications)
  ◊ drawing graphics

10.2.3 ______________________
- a video pointing device
- controls the direction of movement of an object displayed on a VDU
- typical application is _______________________

10.2.4 ______________________
- a video pointing device
- it is a flat panel that typically rests on a table top and produces accurate coordinates values for the locations of a hand-held electrical stylus pressed against its surface
- typical applications:
  ◊ map tracing
  ◊ graph tracing
  ◊ Chinese character recognition
10.2.5

- It can scan text and images into a computer for display, storage and further processing
- The resolution is about 100 - 1200 dpi (Dot Per Inch), hence very fine image like coloured photographs can be captured
- When incorporated with graphics software, images captured can be processed
- When incorporated with OCR (Optical Character Recognition) software, typewritten or even handwritten text can be converted to computer text document
- Typical applications:
  - Desktop publishing
  - Graphics design

10.3 COMMERCIALALLY-USED INPUT DEVICES

10.3.1 Punched Card Reader

- Reads data in a form of the patterns of holes punched on the punched cards and converts it into a series of electric pulse for the computer to process
- Typical speed is 30 cards per second or 1600 character per second
- Typical applications:
  - Historically it is the major method of feeding data into a computer

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each card is a complete record; the characters are both human readable as well as machine readable; records can be added, deleted, replaced and sorted easily; it is a cheap form of storage</td>
<td>Usually fewer than 80 columns are used - a waste of space; punched cards are bulky; the handling of punched cards is slow</td>
</tr>
</tbody>
</table>

10.3.2 Scanner

- Bar code use small parallel printed strips of proper spacing to represent data
- Typical applications:
  - Computerised supermarket checkout (UPC system)
  - Computerised library checkout (ISBN system)
  - Book price identification

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic and reliable data entry; shorter checkout time; higher accuracy compared with manual input; automatic and instant records for further processing e.g. sales reports, stock control</td>
<td>Supporting only a limited number of characters</td>
</tr>
</tbody>
</table>
10.3.3 **Character Reader**

- Characters are printed with ink containing magnetizable substance in standard fonts:
  - MICR font CMC7 used in Europe
- The iron oxide particle can be recognized by magnetic ink character reader
- Typical applications:
  - Reading data on bank cheques and deposit slips

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>automatic and reliable source data entry</td>
<td>expensive to print with magnetisable ink with the required accuracy</td>
</tr>
<tr>
<td>both human and machine readable</td>
<td></td>
</tr>
<tr>
<td>fast (up to 2500 documents per minute)</td>
<td>only 14 different characters in E13B</td>
</tr>
<tr>
<td>high security (extremely difficult to alter the MICR figures)</td>
<td></td>
</tr>
</tbody>
</table>

10.3.4 **Character Reader**

- Optical character readers are designed to recognize characters printed in specific fonts;
- When the characters are scanned, the reflected light is focused on a photoelectric cell and it produces a pattern of electric signals which are compared with the form of standard fonts for recognition
- Typical applications:
  - Utility company bills
  - Bank, credit card company, insurance company documents

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>automatic source data entry</td>
<td>specific type fonts needed</td>
</tr>
<tr>
<td>human readable form</td>
<td>often reliability not up to standard</td>
</tr>
<tr>
<td>fast (up to 2500 characters per seconds or 100 to 1600 documents per minute)</td>
<td>economical only with high volume document</td>
</tr>
</tbody>
</table>

10.3.5 **Optical Marker Reader**

- It senses the presence of marks in the predetermined positions on a form by optical mark readers photoelectrically
- The technique is called optical mark recognition (OMR)
- Typical applications:
  - Reading multiple choices answer sheets in public examination
  - Mark Six Lottery ticket

10.4 **NEW INPUT DEVICES**

- Microphone
- Touch screen
- Voice-recognition
- Portable data entry keypads for EPS
10.5 COMMON OUTPUT DEVICES AND OUTPUT MEDIA

10.5.1 Visual Display Unit (VDU)
- information is displayed by a Cathode Ray Tube (CRT) at a very high speed
- it can display text, graphics shape and fine pictures
- it produces a temporary output which is called soft copy

10.5.2 Printers
- printers produce a permanent output which is called hard copy
- printers may be classified according to
  ◇ printing speed (a character, a line or a page at a time)
  ◇ mechanism (way of printing the characters)

![Diagram of printer classification]

**Figure 1 Classification according to printing speed**

**Figure 2 Classification according to mechanism**

10.5.3 Dot matrix printer
- a character is printed by striking a combination of pin against the ribbon onto the paper
- the printing quality increases with the number of pins (typically 9 or 24 pins) used in the printing head
- typical speed: 100-200 characters per second (cps)

10.5.4 Daisy Wheel Printer
- consists of a wheel and a number of spokes with type casts of characters at their tips
- the wheel is rotated so that any characters can be pressed against a ribbon onto the paper
- fonts of characters can be selected by replacing the wheel
- typical speed: 40-60 cps
10.5.5  Chain Printer
- consists of a rapidly moving chain carrying several complete sets of characters
- as the selected character passes the required position, it is hammered against the paper with ink ribbon in between
- typical speed: 600 - 2000 lines per minute (lpm)

10.5.6  Drum Printer
- consists of a drum constantly rotating at a high speed
- a set of hammers strikes the paper against the ribbon to print all the A's on a line, then all B's on the same line, and so on until the line is completed
- typical speed: 600 - 2000 lpm

10.5.7  ______________ Printer
- makes use of electric, photographic, and laser technologies
- it can produce very fine images (text or graphics)
- generally expensive though its price has been dropping rapidly
- typical speed: 10 pages per minutes (ppm)

10.5.8  ______________ Printer
- drops of electrically charged ink are sprayed toward the paper positions of the paper
- the price has dropped rapidly as it gains more and more popularity
- typical speed: 300 cps

10.5.9  Electrothermal Printer
- uses thermal method to mark characters onto paper
- prints on a special heat-sensitive paper (like fax paper) which will be darken when the temperature exceeds 65 °C
- typical speed: 50-80 cps

10.5.10  Comparison between Impact and Non-impact Printer

<table>
<thead>
<tr>
<th>IMPACT PRINTER</th>
<th>NON-IMPACT PRINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>◊ generally slower</td>
<td>◊ very high speed</td>
</tr>
<tr>
<td>◊ noisy</td>
<td>◊ operated almost silently</td>
</tr>
<tr>
<td>◊ can give multiple carbon copies</td>
<td>◊ cannot give multiple carbon copies</td>
</tr>
<tr>
<td>◊ cheap</td>
<td>◊ generally expensive</td>
</tr>
</tbody>
</table>
### 10.6 OTHER OUTPUT DEVICES OR OUTPUT MEDIA

- Speakers
- Plotter
- Computer On Microfilm (COM)
- Speech Synthesizer

### 10.7 CHOOSING THE APPROPRIATE INPUT/OUTPUT DEVICES

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>INPUT DEVICE(S)</th>
<th>OUTPUT DEVICE(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Aided Design (CAD)</td>
<td>◊ Mouse, ◊ Graphics tablet</td>
<td>◊ High resolution coloured graphics display VDU ◊ Coloured plotter</td>
</tr>
<tr>
<td>Printing a high volume of reports</td>
<td>----</td>
<td>◊ Line printers</td>
</tr>
<tr>
<td>Desktop Publishing</td>
<td>◊ Mouse, ◊ Graphics tablet</td>
<td>◊ Laser printer</td>
</tr>
<tr>
<td>Handling bank cheques</td>
<td>◊ Magnetic ink character reader</td>
<td>◊ High speed printer ◊ Computer on microfilm</td>
</tr>
</tbody>
</table>