# Computers II Lesson 1

## 1.0 Introduction to Software

We need software to run the modern world.

Software engineering is essential for the functioning of national and international societies.

National infrastructures and utilities are controlled by computer-based systems and most electrical products include a computer and controlling software.

Industrial manufacturing and distribution is completely computerized, as is the financial system.

The music industry, computer games, and film and television, is software dependent.

Software systems are abstract and intangible.

However, because there are no natural limits to the potential of software, software systems can quickly become:

- Extremely complex
- Difficult to understand
- Expensive to change

Software engineering is intended to support professional software development, rather than individual programming.

Software engineering is an engineering discipline that is concerned with all aspects of software production.

Good Software:

- Should deliver the required functionality
- Should deliver performance to the user
- Should be maintainable, dependable, and usable

There are two kinds of software products:

- Generic products
- Customized products

There are two key aspects when designing software:

1. Engineering Discipline
2. Software Production

The Engineering Discipline states that:

| Product characteristics | Description |
|---|---|
| Maintainability | Software should be written in such a way so that it can evolve to meet the changing needs of customers. This is a critical attribute because software change is an inevitable requirement of a changing business environment. |
| Dependability and security | Software dependability includes a range of characteristics including reliability, security, and safety. Dependable software should not cause physical or economic damage in the event of system failure. Malicious users should not be able to access or damage the system. |
| Efficiency | Software should not make wasteful use of system resources such as memory and processor cycles. Efficiency therefore includes responsiveness, processing time, memory utilization, etc. |
| Acceptability | Software must be acceptable to the type of users for which it is designed. This means that it must be understandable, usable, and compatible with other systems that they use. |

The Software Discipline states:

Software engineering is not just concerned with the technical processes of software development.

It includes activities such as:

- Software project management
- The development of tools, methods, and theories to support software production.

There are four fundamental activities that are common to all software processes:

1. Software specification - customers and engineers define the software that is to be produced and the constraints on its operation.
2. Software development - software is designed and programmed.
3. Software validation - software is checked to ensure that it is what the customer requires.
4. Software evolution - software is modified to reflect changing customer and market requirements.

There are three general issues that affect many different types of software:

1. **Heterogeneity** -Systems are required to operate as distributed systems across networks that execute on different types of computer and mobile devices. You often have to integrate new software with older legacy systems written in different programming languages. The challenge here is to develop techniques for building dependable software that is flexible enough to cope with this heterogeneity.
2. **Business and social change** - Business and society are changing incredibly quickly as emerging economies develop and new technologies become available. They need to be able to change their existing software and to rapidly develop new software.
3. **Security and trust** - It is essential that we can trust that software. This is especially true for remote software systems accessed through a web page or web service interface. We have to make sure that malicious users cannot attack our software and that information security is maintained.

There are three important types of systems:

1. An embedded system - This is a system where the software controls a hardware device and is embedded in that device. Issues in embedded systems typically include physical size, responsiveness, and power management. The example of an Embedded system is a software system to control a medical device.

2. An information system - This is a system whose primary purpose is to manage and provide access to a database of information. Issues in information systems include security, usability, privacy, and maintaining data integrity. The example of an information system is a medical records system.

3. A sensor-based data collection system - This is a system whose primary purpose is to collect data from a set of sensors and process that data in some way. The key requirements of such systems are reliability, even in hostile environmental conditions, and maintainability. The example of a data collection system is a wilderness weather station.

## 1.1 Designing an Information System

The MHC-PMS (Mental Health Care-Patient Management System) is an information system that is intended for use in clinics. It makes use of a centralized database of patient information.

The MHC-PMS has two overall goals:

1. To generate management information that allows health service managers to assess performance against local and government targets.

2. To provide medical staff with timely information to support the treatment of patients.

When designing this system, we must analyze what can occur naturally due to mental health problems and incorporate a solution into the system.

- Patients are often disorganized so may miss appointments,
- Deliberately or accidentally lose prescriptions and medication,
- Forget instructions,
- Make unreasonable demands on medical staff.
- They may drop in on clinics unexpectedly.
- In some cases, they may be a danger to themselves or to other people.
- They may regularly change address
- May be homeless on a long-term or short-term basis.
- Where patients are dangerous, they may need to be confined to a secure hospital for treatment and observation.

Users of the system include:

- Doctors
- Nurses
- Health visitors (nurses who visit people at home to check on their treatment).

Nonmedical users include:

- Receptionists who make appointments
- Medical records staff who maintain the records system
- Administrative staff who generate reports

The system is used to record:

- Information about patients (name, address, age, next of kin, etc.),
- Consultations (date, doctor seen, subjective impressions of the patient, etc.), conditions, and treatments.
- Reports are generated at regular intervals for medical staff and health authority managers.
- Typically, reports for medical staff focus on information about individual patients whereas management reports are anonymized and are concerned with conditions, costs of treatment, etc.

The key features of the system are:

1. Clinicians can create records for patients, edit the information in the system, view patient history, etc. The system supports data summaries so that doctors who have not previously met a patient can quickly learn about the key problems and treatments that have been prescribed.

2. The system regularly monitors the records of patients that are involved in treatment and issues warnings if possible problems are detected. If a patient has not seen a doctor for some time, a warning may be issued. One of the most important elements of the monitoring system is to keep track of patients who have been sectioned and to ensure that the legally required checks are carried out at the right time.

3. The system generates monthly management reports showing the number of patients treated at each clinic, the number of patients who have entered and left the care system, number of patients sectioned, the drugs prescribed and their costs, etc.