Importance and Role of Software:

The time frame in which computers and software have developed has barely been more than 75 years. Yet their impact on individual humans and on societies has been as important as the printing press, airplanes, television, and automobiles.

The following is a summary of tools and applications that have transformed the way businesses operate; wars are fought; and individuals gather information, communicate, and use their leisure time. It is surprising that these have all originated within the past 50 years. Probably half of these tools and applications are less than 25 years old.

- Business tools
    - Accounting
    - Actuarial studies
    - Advertising via the web
    - Agricultural planning
    - Analytics
    - Bar-code scanners
    - Big data
    - Budget analysis
    - Cloud computing
    - Competitive analysis
    - Cost and resource tracking
    - Cost estimating
    - Crowdsourcing
    - Customer relationship management (CRM)
    - Customer satisfaction analysis
    - Customer support
    - Distribution optimization analysis
    - Electric power grid controls
    - Enterprise resource planning (ERP) packages
    - Finance
    - Governance
    - Human resource management
    - Inventory
    - Investments
    - Just-in-time inventory controls
    - Legal support
    - Marketing
    - Oil exploration
    - Order entry
    - Order tracking
    - Planning and scheduling
    - Process controls
    - Reservation systems
    - Risk estimation and analysis
    - Robotic manufacturing
    - Sales support
    - Supply chain management
    - Surveys and opinion analysis
    - Telephone network controls
    - Water purification
    - Web retailing

- Databases
  - Graphics and images
  - Music
  - Signals and analog
  - Text and numeric
- Data warehouses
  - Mixed-data forms
- Education tools
  - Comparative education statistics
  - Curriculum planning
  - Customized e-learning for each student
  - Skills inventory analysis
  - Special tools for the handicapped
  - Student research via the web
  - Virtual classrooms
- Embedded devices
  - Automotive engines and brakes
  - Automotive security systems
  - Avionic
  - GPS navigation
  - Hearing aids
  - Manufacturing
  - Medical
  - Signal processing
  - Smart appliances
  - Telecommunications
- Government tools
  - Air traffic control
  - Background verification
  - Budget analysis
  - Census
  - Court records
  - Disaster preparedness
  - Economic analysis
  - Employment statistics
  - Environmental monitoring
  - Financial controls
  - Health and longevity statistics
  - Highway siting, design, and construction
  - Identity verification
  - Land management
  - Law enforcement
  - Legislative records
  - Mandates and regulations
  - National defense
  - Patent analysis
  - Political records
  - Pollution monitoring
  - Prisons
  - Property assessments
  - Redistricting
  - Regulatory agencies

- o Risk analysis
- o Taxation
- o Traffic analysis and controls
- o Unemployment support
- o Voter records
- o Water supply controls
- o Welfare
- o Zoning
- Leisure
  - o Blu-ray and digital video
  - o Computer games
  - o Digital music formats
  - o Geocaching
  - o Music playlists
  - o Online magazines
  - o Streaming video
  - o Virtual reality worlds
- Medical
  - o Coordination in real time among medical teams
  - o External devices
  - o Implanted devices
  - o Insurance record keeping
  - o Lab tests
  - o Patient hospital monitoring
  - o Patient records
  - o Robotic surgical devices
  - o Statistics: national, global
- National defense
  - o Antimissile shields
  - o Combat simulation
  - o Command and control
  - o Cybersecurity
  - o Deep ocean monitoring
  - o Early threat warnings
  - o Encryption and decryption
  - o Intelligence gathering and coordination
  - o Logistics analysis
  - o National Security Agency signal interception
  - o Satellite monitoring
  - o Secure communications
  - o Threat analysis
- Personal tools
  - o Blogs
  - o Computers
  - o Contact lists
  - o Daily news feeds
  - o Digital appliances
  - o Digital cameras
  - o Digital image processing
  - o Digital watches
  - o E-books
  - o Email

- Graphics
- handheld full-function digital calculators
- Handicap support for the deaf, blind, etc.
- Home finances
- Instant computer chat
- Music
- Natural language translation
- Presentations
- Scheduling
- Search engines
- Smartphones
- Social networks
- Spreadsheets
- Statistics
- Tablet computers
- Text to speech
- Video processing
- Web browsers
- Word processing
- Professional tools
  - Accounting
  - Analytics
  - Animation and graphic arts
  - Architecture
  - Civil engineering
  - Computer animation
  - Data mining
  - Drafting
  - Economic analysis
  - E-learning
  - Encryption and decryption
  - Engineering
  - Intelligent agents for web scanning
  - Law enforcement
  - Legal support
  - Math
  - Medical support
  - Music composition
  - Music recording, playback, and mixing
  - National security
  - Patent analysis
  - Pharmaceutical
  - Project management
  - Property management
  - Publishing
  - Real estate listings
  - Spell checkers and grammar checkers
  - Statistics
- Programming tools
  - Application sizing
  - Automatic testing
  - Complexity analysis

- o Configuration controls
- o Continuous integration
- o Cost and schedule estimation
- o Data mining of legacy applications
- o Debugging
- o Inspection support
- o Maintenance and support estimation
- o Measurements and benchmarks
- o Programming language compilers
- o Quality estimation
- o Requirements and design analysis
- o Requirements modeling
- o Reusability analysis
- o Risk estimation
- o Static analysis
- o Test tools (design and execution)
- o Virtualization
- o Website design and construction
- Protective tools
  - o Antispam
  - o Antispyware
  - o Antivirus
  - o Smart alarm systems
- Scientific tools
  - o Archaeological analysis
  - o Astronomical analysis
  - o Biological analysis
  - o Chemical analysis
  - o Computer-enhanced image calibrations
  - o Computer-stabilized optical devices
  - o Deep ocean exploration
  - o DNA analysis
  - o Epidemiology analysis
  - o Forensic analysis
  - o Geological exploration (side-scan radar)
  - o Linguistic analysis
  - o Metallurgy
  - o Meteorology analysis and weather predictions
  - o Nanotechnologies
  - o Nuclear device controls
  - o Physics research equipment
  - o Self-aiming telescopes for the deaf, blind, etc.
  - o Simulations of physical phenomena
  - o Space vehicles, rovers, and satellites
  - o Visualization

As can be seen from this list, computers and software are making profound changes to every aspect of human life: education, work, warfare, entertainment, medicine, law, and everything else.

Harmful Inventions

Computers and software have also introduced a number of harmful inventions that are listed below, some of which did not exist before. Among the harmful inventions caused by computers and software are identity theft, hacking, and computer viruses. These are new and alarming criminal activities.

- Browser hijackers
- Computer botnets
- Computer keyboard tracking
- Computer spam
- Computer spyware
- Computer viruses
- Computer worms
- Computerized customer support
- Difficulty in correcting errors in computerized data
- Electronic voting machines without backup
- Hacking tools
- Identity theft
- Phishing
- Piracy
- Robotic telephone calls (robo-calls)
- Robotic weapons systems
- Smart weapons: bombs, drones, and missiles
- Spam
- Special viruses attacking industrial equipment
- Spyware
- Stock market software without anomaly shutoffs
- Unintelligible telephone voice menus
- Web pornography

These threats are comparatively new and all are increasingly hazardous in the modern world. Indeed, identify theft has become one of the largest and most pervasive crimes in human history. It is also an example of a new kind of crime where the criminal and the victim never see each other and can be separated by more than 12,000 miles when the crime takes place.

These harmful aspects of computers and software have triggered new laws and new subindustries that provide virus protection, hacking insurance, and other forms of protection.

Role of Software:

Today, software takes on a dual role. It is-
1) a **product** and, at the same time,
2) the **vehicle** for delivering a product.

As a product:
- It delivers the computing potential embodied by computer hardware or, more broadly, a network of computers that are accessible by local hardware.
- Whether it resides within a cellular phone or operates inside a mainframe computer, software is information transformer— producing, managing, acquiring, modifying, displaying, or transmitting information that can be as simple as a single bit or as complex as a multimedia presentation.

As the vehicle used to deliver the product:
- Software acts as the basis for the control of the computer (operating systems), the communication of information (networks), and the creation and control of other programs (software tools and environments).
- Software delivers the most important product of our time—*information.*
  - ➢ Software transforms personal data (e.g., an individual's financial transactions) so that the data can be more useful in a local context;

➤ it manages business information to enhance competitiveness;
➤ it provides a gateway to worldwide information networks (e.g., Internet) and provides the means for acquiring information in all of its forms.

The role of computer software has undergone significant change over a time span of little more than 50 years.

- Dramatic improvements in hardware performance, pro- found changes in computing architectures, vast increases in memory and storage capacity, and a wide variety of exotic input and output options have all precipitated more sophisticated and complex computer-based systems.
- Sophistication and complexity can produce dazzling results when a system succeeds, but they can also pose huge problems for those who must build complex systems.