ICAU2005B:
Operate Computer Hardware

Student Handbook
# Modification History – Competency Handbooks

<table>
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<tr>
<th>Version</th>
<th>Date of Release</th>
<th>Authorisation</th>
<th>Comments</th>
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<tr>
<td>1.00</td>
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<td>Primary Release</td>
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**Forms Control:**

All documents related to the delivery or assessment of ICA20105: Cert II in Information Technology will have a version number displayed in the footer of the document. This Modification History page will appear after each title page of a handbook to ensure that the materials involved in the delivery and assessment of the certificate remain in a constant state of ongoing review and improvement. Comments on changes will only show sufficient detail to enable a user to identify the nature and location of the change. Documents will be reviewed at least on an annual basis at the official internal review and fellow instructors and industry representatives will be consulted throughout the year in informal discussion.
UNIT CODE: ICAU2005B

UNIT TITLE: Operate Computer Hardware

Description

This unit defines the competency required to apply skills and knowledge in using new or upgraded technology.

Elements of Competency

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<th>ICAU2005B/01</th>
<th>Identify computer hardware components</th>
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<td>Identify external hardware components and peripherals</td>
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<td>Identify internal hardware components</td>
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<table>
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<tr>
<th>ICAU2005B/02</th>
<th>Understand the inter-relationship between computer hardware and software</th>
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<td>2.1</td>
<td>Describe the functions of computer hardware and associated OH&amp;S standards and environmental considerations around hardware use and disposal</td>
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<td>2.2</td>
<td>Describe the function of a computer operating system</td>
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<td>Describe the boot process</td>
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<td>State the relationship between an application program, the operating system and hardware</td>
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<td>2.5</td>
<td>State the general differences between the different computer platforms and their respective operating systems</td>
</tr>
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<td>2.6</td>
<td>Draw a simple block (schematic) diagram showing the interconnection of the various components of a computer</td>
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<table>
<thead>
<tr>
<th>ICAU2005B/03</th>
<th>Use computer input equipment</th>
</tr>
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<tbody>
<tr>
<td>3.1</td>
<td>Follow OH&amp;S standards and organisational policies and procedures when using computer input equipment</td>
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</table>
Ergonomics

Ergonomics is the study of efficiency, comfort and safety of people in their working environment. Ergonomics for text processing operators covers the following.

Computer Hardware

Keyboard
Ideally, the keyboard should allow the operator to work with his or her elbows at a 90-degree angle. The following steps can reduce strain on the hands and wrists.

1. Use a padded wrist rest placed in front of the keyboard.
2. Keep your hard copy next to and at the same distance from your eyes as the screen.
3. Don't pound the keys. This sends shockwaves up the arms that can create or aggravate problems with the fingers, wrists and arms.
4. Don't overreach when reaching for the function keys. This causes the finger tendons to stretch. Move your hand closer to the desired key before pressing it.

Mouse
Place your hand so it rests on the mouse with your index finger resting on the left mouse button, your middle finger resting on the right mouse button and remaining two fingers at the right of the mouse. The mouse is positioned at the right or left of the keyboard. A wrist rest helps to prevent RSI (Repetitive Strain Injury) problems from occurring.

Monitor
Poor visibility can cause eye irritation and headaches. An anti-reflective or polarising filter or treatment may be attached or applied to the monitor to cut down glare and help reduce radiation. You can also avoid radiation by ensuring you are not seated at the side or back of other monitors.

To prevent eyestrain, take the following steps.

1. The top of the screen should be just below eye level. To do this, you may need to reposition your system unit and use a separate stand for your monitor.
2. Adjust your monitor for maximum contrast and minimum brightness.
3. Reduce reflections by tilting the screen and avoid locations where the monitor directly faces towards or away from bright window light.

   The monitor should also be adjusted to avert the glare from direct lighting. A glare screen and dark clothing can help reduce reflections.
4. Blink often when using a computer to prevent dry eyes and headaches and look away from your screen often.
The Chair

A well designed, adjustable chair is one of the most important factors in preventing posture problems. Your chair should be adjustable vertically (usually between 38 cm and 52 cm in height) and be adjustable while you are seated.

You should be able to sit with both feet on the floor and there should be no pressure against the lower back or your thighs - you should be able to fit one hand-width between the seat and the back of your knee.

Sit comfortably in your chair ... not too far back, and not perched on the edge of your seat.

The Desk

If the height of your chair and foot-rest are fixed then you must be able to adjust the height of your desk. Normally, a desk should allow the keyboard to be around 60 cm to 78 cm off the ground and give you around 40 cm of leg room.

The table should allow you to position the centre of the screen at a height to suit you. If the desk is not adjustable then it is even more important for the chair to be adjustable.

The desk should be big enough to allow the keyboard, screen controls (on/off, brightness), documents, document carrier, and any other items which you use regularly (telephone, desk caddy, etc) to be within easy reach. It should also be as thin as practical, ideally less than 2.5 cm to give you maximum knee room.
Decor and Lighting
In order to reduce glare, rooms should be decorated in pastel shades. Blinds should be used to prevent strong sunlight from entering the room. Workstations should be located away from windows and positioned to avoid reflections. Where possible use natural light and blinds to control the light. In most offices a combination of natural and artificial light is used. Fluorescent lighting is usually the standard lighting used in office situations.

Room Temperature and Ventilation
Computers produce heat which can make your work space warmer than the rest of the office. Make sure the screen is not hard up against a wall or partition and that there is plenty of air flow around the unit. A small desk fan may be necessary if you are working in a confined space. Windows can be used for additional ventilation.

The combined effects of heat and humidity can produce dryness and eye irritation. The best environment is with a relative humidity of 45 per cent or greater. Air conditioning can lead to a dry atmosphere.

Noise
People and equipment, i.e. printers, photocopiers, phones, etc contribute to the noise factor within an office. If possible such equipment should be placed in areas away from where people are working to reduce noise levels.

Health Problems
Occupational overuse syndrome (OOS) and repetitive strain injury (RSI) are collective terms for a range of conditions, including injury, characterised by discomfort or pain in the muscles, tendons and other soft tissues, with or without physical signs. Symptoms can include:

- fatigue
- a burning sensation
- aches and pains
- weakness
- muscle discomfort
- stiffness
- soreness
- numbness and tingling.

The risk factors for OOS or RSI can be summarised as:

- Poor planning for VDU work
- Poor work organisation
- Inappropriate selection of computer hardware and software
- Inappropriate selection of office furniture
- An inappropriate VDU environment
- Poor workstation layout
- Lack of education, training and skills.

It is important that steps be taken to prevent these health problems from occurring. Repetitive tasks should be minimised and work breaks taken. Exercises should be used to stimulate blood flow - to help reverse the effects of muscle tension - and help you to relax. Ensure that your posture is correct at all times and report any aches and pains promptly so that they can be dealt with before they become severe or chronic.

Work Breaks
Operators should be given frequent breaks away from their terminals in order to avoid eyestrain and posture problems. The recommended break is 10 minutes every hour worked where work is screen-intensive. Try to vary tasks and take a break from your computer to do filing, make business phone calls, etc.
Micropauses

A micropause is a short break in work for muscle relaxation. Specifically, it is a 5-10 second break in work for muscle relaxation every three minutes or so. Micropauses allow for the restoration of blood flow to muscles which have been held tense. It is when the muscles relax fully that micropauses are of most value. They help you be more productive. A variation to exercises is simply to count your breaths.

Exercises

Exercises should be done at regular intervals. These should include head rolls, shoulder lifts and wrist drops. Wrist drops simply involve dropping the arms down vertically with your body and shaking your wrists.

Eye Exercises

To avoid eye strain when using a computer screen do the following.

- Blink often to prevent the surface of your eyes drying out and becoming irritated.
- Stare off into space - every now and then look across the room or out the window.
- Adjust your screen so it is not too bright.
- Use a glare screen to minimise glare reflected back into your eyes.
- Wipe the dust off your screen regularly.
- Use the clock at the right to practise eye exercises (you can also do these exercises in greater movements shown in brackets below).

12 to 6  (from ceiling to floor)
9 to 3    (from one side of the room to the other)
1 to 7
11 to 5

Now close your eyes for a few seconds, relax and open your eyes. Begin at 12 and circle around to 3, 6, 9 and back to 12 three times. Reverse directions, then close your eyes and relax.

- To release tension in your face around your eyes, close them tightly and gently squeeze, allowing your facial muscles to draw up. Hold for two seconds, relax your face and open your eyes, then open your mouth wide while raising your eyebrows. Repeat three times.

Additional items that will assist in correct posture and comfort at your workstation are described below.

Foot-rest

A foot-rest is useful when the desk and chair cannot be adjusted and can be used to ensure proper posture. Ideally the foot-rest slope should be comfortable, 0°-10° is recommended, with a flat surface area of 350 x 450 mm.
Copy-holder

A copy-holder makes it possible to view documents without excessive neck bending. It should be large enough to support the copy placed on it and should be stable in all positions. Position the copy-holder so it is comfortable, usually on a slight angle at the left of the screen.

Checklist

Before starting work each lesson and during, make sure that you are addressing all the below Workplace Health and Safety issues. Your teacher will be observing you at different times to mark down on your records.

<table>
<thead>
<tr>
<th>Ergonomics</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>I have -</em></td>
</tr>
<tr>
<td>Adjusted my chair correctly.</td>
</tr>
<tr>
<td>Ensured my monitor is at the correct brightness/contrast/height for my own personal requirements.</td>
</tr>
<tr>
<td>Ensured that the room temperature can be adjusted when necessary by the use of fans/heaters or air-conditioning.</td>
</tr>
<tr>
<td>Practised exercises to use when taking micropauses.</td>
</tr>
<tr>
<td>Ensured that I have the correct posture when seated at my workstation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health and Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>I have -</em></td>
</tr>
<tr>
<td>Kept my desk tidy and uncluttered of unnecessary papers and objects.</td>
</tr>
<tr>
<td>Checked that leads are positioned where people cannot trip over them.</td>
</tr>
<tr>
<td>Ensured that my equipment is not overloading power sockets.</td>
</tr>
<tr>
<td>Remembered to switch off power when cleaning my equipment.</td>
</tr>
</tbody>
</table>
What are Input/Output (Peripheral) Devices?

Input/Output devices are peripherals that allow the user to communicate with the computer. Some devices accept data from users (input) and some show the response from the computer’s processing (output).

How do they work?

**Keyboard:**
- each key is assigned an ASCII value (0-255)
- each ASCII character is a unique combination of 0 and 1’s
- when a key is pressed that combination is sent to the Input/Output controller and then to the CPU

**Screen:**
- Data from the CPU (in form of 0’s and 1’s) is converted to symbols which are then displayed on the screen.

**Facts:**
- Input/Output devices are needed to allow the user to communicate with the CPU.
- Many input devices are available: Mouse, keyboard, scanner, sound, video etc.
- Input is divided into 4 types: data, programs, commands and user responses.
- Output is data that has been processed and displayed in the way the user can understand.
- Output devices include screen and printer.

Activity 1

1. A small IT company you work for needs to update their printer. They require a colour ink jet printer. The budget is approximately $500. They would like to have the ability to scan and photocopy (ie a multifunction center). Research two different options from printers you find for sale from the Internet. Display the information in a table with the headings:

<table>
<thead>
<tr>
<th>Brand</th>
<th>Pages per minute</th>
<th>Connection (eg USB?)</th>
<th>Photo</th>
<th>DPI</th>
<th>Cartridge Replacement Costs</th>
<th>Other Features</th>
</tr>
</thead>
</table>

2. For each of the input devices listed below, describe how it works, find a picture, describe where it would be preferable to use this device rather than some other device. Display this information in a table in Word. Devices to research are:

keyboard, mouse, trackball, touchpad, pointing stick, joystick, pen input, touch screen, scanner, optical recognition (bar codes), digital camera, video input, electronic whiteboard

3. Find out how an LCD monitor displays colour. Compare and contrast 15 inch screens with 17 inch and larger screens.
What is Memory?

- Storage devices for holding data and instructions
- Short term storage for data needed by the CPU is called RAM (Random Access Memory). RAM is fast but has limited storage capabilities. The bigger the RAM the faster the processing. RAM is volatile and is cleared when the power is turned off.
- Internal memory is broken into RAM and ROM. ROM (Read Only Memory) uses the upper memory area of the internal memory. ROM contains commands to allow the computer to boot up and cannot be cleared by turning off the power, i.e. Non-volatile.

How Does Memory Work?

Internal memory (RAM) is a set of chips that stores data and instructions. The chip consists of thousands of transistors that can switch and hold a 0 or 1. Other internal memory is in the form of a cache – part of RAM that is very fast and so access times to data is reduced – and registers which are very fast memory attached to the CPU.

Facts:

- Internal memory is made up of integrated circuits containing thousands of transistors that store 0 or 1.
- Internal memory is RAM, ROM and BIOS
- RAM is volatile, holding instructions and data being used by the CPU
- RAM Cache is high speed memory for frequently used instructions
- ROM is non-volatile, holding instructions that cannot be deleted
- BIOS (Basic Input Output System) stores information on what the computer needs to do to start up. It doesn’t lose its memory when the power is switched off due to it having its own battery.
- Buses are paths along which bits are transmitted.

Primary Storage or Secondary Storage?

RAM is the primary or main form of storage on a computer, as discussed above. Secondary storage is different. Secondary storage holds permanent or semi-permanent data while it is not being processed. Secondary storage devices can provide long-term storage and can also be used as input and output devices. Secondary storage is compact, reliable, convenient and economical. Some of these devices include:

- External Hard Disk Drives (HDD)
- Tape Drives
- CD Drives
- Floppy Disk Drives (outdated technology)
- USB storage devices

Activity 2

Using Microsoft PowerPoint, create a presentation on Secondary Storage. Include an introductory slide which explains what Secondary Storage is, and then have a slide for each of the devices above. Cover the information below for each device:

- What is it used for?
- Price?
- How does it work?
- Storage sizes available
- Picture of example
What are Servers?

A central server is a large, powerful computer system. It will combine the functions of a file server, a print server, and application server and a communication server (or router). These servers can also be found as smaller, individual, less powerful computers that are dedicated to the particular task.

A central server will have multiple (large) hard drives that can be not swapped for reliability and a backup system. It therefore needs a specialised multitasking Operating System and a variety of management and monitoring programs. It will store and run all the application software for the network and store all the client’s data.

How do Servers Work?

A client uses a computer (PC, Laptop, PDA etc.) to run small programs to communicate with the server. The client sends a request for a file to the server. All processing and data storage is done on the server and screen images are sent to the client. The client then has full use of powerful applications programs and large storage without the cost and security problems involved in having individual computers able to handle current sized applications. The client PC may store certain local programs that can be run on the PC on instructions from the server. These local programs can also be run when the client is not logged onto the network.

What are Processors (CPU)?

- A ‘chip’ that is the heart of the computer
- It controls all the tasks performed from fetching instructions from memory, decoding them into computer language, executing the commands and storing the result in memory (Control Unit)
- The CPU also contains an ALU that performs all the Arithmetic and Logic functions
- The CPU contains registers for temporary storage of data and works on the pulse rate of the system clock (Ghz/Mhz)

How do Processors Work?

- Data and instructions continually pass into the CPU via the bus system
- The CPU works on an instruction set. A CISC (Complex Instruction Set Computer) is able to understand many instructions. A RISC (Reduced Instruction Set Computer) has instructions that are briefer and the same length (32 bits) so they run faster.
- The chip is a small silicon wafer containing a vast electronic circuit with millions of transistors
- The chip sits in a socket that connects it to the rest of the motherboard.

Facts:

- Servers have large capacity HDD’s
- Servers usually have 2 HDD’s running parallel containing the same applications programs and data. Both are updated at the same time. If one develops a problem it can be swapped without affecting the running of the network.
- Processors deal in digital data – 0 and 1 – called Bits.
- A 32 bit machine can process 4 ‘words’ at a time. A 64 bit machine processes 8 ‘words’ at a time so it is therefore faster.
- Each byte contains a parity bit that is used for error checking. For even parity all the 0 and 1’s are added up. If the result is even then the parity bit is 0, if the result is odd then the parity bit is 1.
**System Unit:**

The system unit is also called the system box or system main unit. It is a plastic or metal box housing the motherboard, internal disk drives, power supply, cooling fans, and circuit boards that are plugged into the motherboard. It includes the central processing unit (CPU), memory and associated electronics.

The CPU is plugged into the motherboard and is the main processor of the computer. The motherboard supplies the data and power infrastructure, linking the other components together. Some peripherals that are included in the system unit are disk drives, sound cards and video cards, as discussed previously.

The following components are found in the system unit:

<table>
<thead>
<tr>
<th>- Motherboard</th>
<th>- Chipsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>- CPU</td>
<td>- Memory Chips</td>
</tr>
<tr>
<td>- Cooling system or fan</td>
<td>- Power supply</td>
</tr>
<tr>
<td>- Expansion boards</td>
<td>- Bus</td>
</tr>
<tr>
<td>- Power supply</td>
<td>- Ports</td>
</tr>
<tr>
<td>- Disk drives</td>
<td>- Disk drives</td>
</tr>
</tbody>
</table>

![Back of computer case and each connection](image-url)
Processing

The processor is the CPU (Central Processing Unit) and is also known as a microprocessor. It is the “brain” of the computer, the part that is responsible for carrying out instructions and doing calculations. The CPU consists of three or more parts:

- Control Unit
- ALU (Arithmetic/Logic Unit)
- Memory Unit.

The CPU interacts closely with the primary storage, or memory. The memory allows data to be temporarily stored while the computer is executing a program, that is, RAM and ROM. Basic computing operations consist of four steps:

- Fetching
- Decoding
- Executing
- Storage

This is known as the fetch-execute cycle, and the CPU does this repeatedly. The diagram below illustrates this cycle:

Operating Systems

The Operating System is the platform software that interfaces your hardware to the software applications you want to run. All individual pieces of software that you use (Microsoft Word, MYOB etc.) cannot run unless they are able to sit and run as part of the operating system. Operating systems can perform the following functions:

- Perform common hardware functions
- Provide user interface
- Provide hardware independence
- Manage system memory
- Manage processing
- Control access to system resources
- Manage files
- Accept keyboard input
- Store data on disks
- Send data to output devices
- Command-based interfaces
How does the Operating System interact with Applications?

Typically System Software invokes (or starts, or executes) the Application Software (such as Microsoft Word). The Application Software then makes calls into the System Software to obtain resources (e.g. more memory), and perform operations on files (read/write), or send messages (tcp/ip). The Systems Software keeps control over which files and/or devices that the application software has access to, and can also control how much memory and even how much CPU time the application software is using.

Different Computer Platforms

In computing, a platform describes some sort of hardware architecture or software framework (including application frameworks), that allows software to run. Typical platforms include a computer's architecture, operating system, programming languages and related runtime libraries or graphical user interface.

In relation to hardware, platform often describes the set of hardware components that make up the computer itself, that the software is written to target (often just described as "written for an ...... architecture"). Pure assembly language can be run on this hardware platform, but most commonly, operating system software is written to target it. But in doing so, it becomes a platform in itself, facilitating the running of other software that is used to target the operating system, and likewise the hardware architecture. Furthermore, software that is written for the operating system can be used to support the running of other software. The three main Hardware platforms are:

- RISC (running a Unix operating system)
- Macintosh Apple Computer (running Mac OS operating system)
- PC (running Microsoft operating systems)
Boot Process

To ‘boot’ means to start the operating system. Booting is the process whereby the computer brings itself up to an operable state without human intervention (apart from turning the computer on). A small program that is permanently stored on the hard disk runs automatically to load the operating system into the main memory (sometimes called the system RAM) so that you can start using it. The operating system can be booted again (‘rebooted’).

There are two main ways of booting a computer system:

- **Hard boot** (also known as cold boot): when the computer is turned off or has no power going to it and you start it up using the power switch (or button);
- **Soft boot** (restart): when the reset button is pressed or the CTRL, ALT and DEL keys are used together.

The operating system is booted automatically when you turn on your computer or restart your system. You can interrupt the boot sequence and begin an interactive session if you need to redefine system keywords (parameters) like the amount of available physical memory. Security measures at school prevent you from doing this on school computers.

**Activity 3**

Answer the following in a Word document:

1. Describe the function of a computer operating system.
2. Describe the boot process. What is the difference between a hard and soft boot?
3. How does the Operating System interact with the Application programs? Draw a diagram with the drawing toolbar to illustrate.
4. What is the fetch-execute cycle? Draw a diagram to illustrate.
5. Research the three different computing platforms. What are their origins? How widely used are they? What operating system do they run? What are the advantages? What are the disadvantages?
Networking

Why Network?

Networking is an effective way of communicating and sharing resources. It allows several computers or workstations to access the same printer. When you use a file server, networking can provide access to disk space for storage and allow you to retrieve files saved by other users. Large organisations may have many servers in their network. With a network you can share databases and use them in more than one location. Files can be backed up in several locations; that is, on different computers.

Designing a Network

When a network is being designed, there are several considerations, including:

- How much data you need to transmit, and thus the bandwidth required (pipe size)
- How fast you need the data to be transmitted (speed will also depend on the bandwidth)
- The number of users
- Whether you might need to expand the network in the future
- What services are provided
- The types of computers that are to be connected
- What software is available
- The costs of setup, running and ongoing maintenance.

Activity 4

In a Word document, research and complete the following questions:

1. Write a definition for the term "Computer Network".
2. What is a LAN and WAN?
3. What are the three requirements for networking?
4. The two principal configurations for a network are Peer to Peer and Client Server. Explain each one.
5. What are the three different types of network cabling? What are the good/bad points for each? Find a picture of each type.
6. Create the below table, completing the blank cells.

<table>
<thead>
<tr>
<th>Method:</th>
<th>How does it work?</th>
<th>Strengths:</th>
<th>Weaknesses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Token Ring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARChnet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDDI</td>
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</tbody>
</table>

7. Find diagrams of two hubless Ethernets (Daisy Chain and Linear Bus).
8. Write a definition for a passive hub network and find a diagram (eg star network).
9. What is a bridge? Find a diagram to illustrate your answer.
10. What is the difference between a router and a bridge.
11. What is a switch?
12. What are the physical hardware and software requirements needed for you to network a few computers?
Computer Security

Computer security is a branch of technology known as information security as applied to computers. The objective of computer security includes protection of information and property from theft, corruption, or natural disaster, while allowing the information and property to remain accessible and productive to its intended users.

Many current real-world computer security efforts focus on external threats, and generally treat the computer system itself as a trusted system. Some knowledgeable observers consider this to be a disastrous mistake, and point out that this distinction is the cause of much of the insecurity of current computer systems — once an attacker has subverted one part of a system without fine-grained security, he or she usually has access to most or all of the features of that system.[citation needed] Because computer systems can be very complex, and cannot be guaranteed to be free of defects, this security stance tends to produce insecure systems.

Financial Cost

Serious financial damage has been caused by computer security breaches, but reliably estimating costs is quite difficult. Figures in the billions of dollars have been quoted in relation to the damage caused by malware such as computer worms like the Code Red worm, but such estimates may be exaggerated. However, other losses, such as those caused by the compromise of credit card information, can be more easily determined, and they have been substantial, as measured by millions of individual victims of identity theft each year in each of several nations, and the severe hardship imposed on each victim, that can wipe out all of their finances, prevent them from getting a job, plus be treated as if they were the criminal. Volumes of victims of phishing and other scams may not be known. Individuals who have been infected with spyware or malware likely go through a costly and time-consuming process of having their computer cleaned.

Activity 5

1. View the video on computer security provided by your teacher. Access the worksheet from the shared directory and type in the answers from the video information. Save into your own drive in your ICAU2005B folder.

2. Using Microsoft PowerPoint, create a simple presentation on Computer Security. Have a brief introduction slide and then have a slide on the three main forms of security – Firewalls, Encryption (use of Keys and Digital Certificates) and Authentication (Passwords and Digital Signatures). For each three describe:
   - How it works
   - Why it is used (in which situations)
   - Effectiveness