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GUIDELINES FOR THE LABORATORY WORK OF THE ACADEMIC DISCIPLINE "COMPUTER ENGINEERING AND PROGRAMMING"

For students in the field of knowledge 14 "Electrical engineering"
specialty 141 " Power engineering, electrical engineering and electromechanics"

Guidelines for the laboratory work of the academic discipline "Computer engineering and programming" / V. Yu. Kashtan – Dnipro University of Technology – Dnipro, 2022.

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Goal of the methodical instructions is to help students during independent study of theoretical principles of discipline " Computer engineering and programming ". The description of the laboratory work includes along with methodical recommendations on theoretical and experimental research (study) of the concepts, principles, design, construction, implementation, and management issues of software engineering.

The guidelines have been discussed and approved at the meeting of the department of Information Technology and Computer Engineering of the Dnipro University of Technology on May 5, 2022, protocol №.19.

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Laboratory work №1

Theme: Basic components of a personal computer in EVEREST Home Edition.
Aim of the work: to study the main components of a personal computer.
Equipment: program EVEREST Home Edition.

1.   Theoretical information

EVEREST HOME EDITION Business Edition is an IT asset management and remote monitoring tool for Windows. With the application, you can collect a very detailed hardware and software inventory from Windows client computers on your company network, and monitor changes in both hardware and software. It also allows you to manage your Windows PCs remotely: for example, you can start and end processes on remote machines with its Remote monitor function. All this can be done without installing EVEREST HOME EDITION Business Edition on each client separately, as the application can be run from a central shared folder. The software can be easily deployed using the downloadable ZIP package and Installation/Setup Guide.

1.1 Main EVEREST HOME EDITION functions

The Business Edition of EVEREST HOME EDITION boasts such unique functions as ondemand automated network audit (hardware and software inventory), remote control, remote monitoring and security alerts, as well as Audit manager, Database manager and Change manager services which help us manage the reports collected from client computers. The product can also be helpful when we purchase new systems and want to make sure that the purchased computers contain all the components we ordered. All this helps the IT investments planning process, can contribute to reducing IT costs and facilitates the everyday job of system administrators. EVEREST HOME EDITION Business Edition does not include some of the functionality of the Extreme Edition, such as overclocking information and benchmarks.

EVEREST HOME EDITION is completely vendor-independent and is compatible with all PCs running 32-bit and 64-bit Microsoft Windows operating systems, including Windows 8 and Windows Server 2012.

As far as the available functions are concerned, it is practically irrelevant if we run EVEREST HOME EDITION on a server or client operating system, unless it is launched using command-line options.

1.2   USER Interface

The main functions of EVEREST HOME EDITION are accessible from the Menu bar. Below the Menu bar, we can find the Toolbar, with which we can navigate through the pages. Located in the left column below the Toolbar, the Page menu displays a list of hardware and software categories, details of which open in the information windows on the right (fig.1).
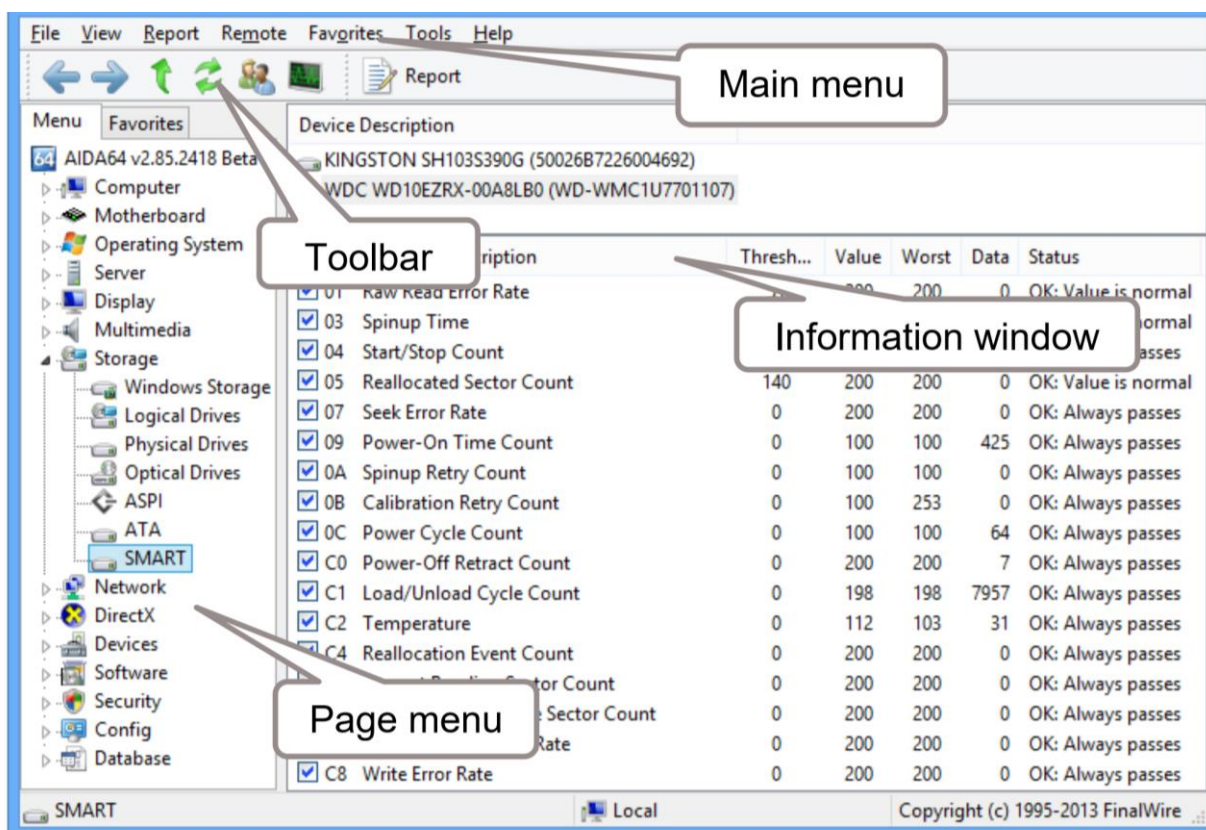
Fig1. User Interface of EVEREST HOME EDITION

1.3 Category "Computer"

The Page menu list "Computer" is grouped into the following categories: summary, Computer name, DMI, IPMI, Overclock, Power Management, Portable computer, Sensor.

1.3.1 Summary

The Summary page lists the main hardware and software components of the given PC. We can select the individual items we would like to see here and add custom variables to the page in Preferences / Summary. We can also add custom components to the Summary page in Preferences / Custom components and custom variables in Preferences / Summary (fig.2).

Clicking on the items highlighted in blue on the page will open a context menu which provides links to the manufacturer's product information page as well as to BIOS and driver download websites.

1.3.2 Computer name

The Windows host name, the NetBIOS name as well as the DNS host and domain names of the PC are listed here.

1.3.3 DMI

Here EVEREST HOME EDITION displays the computer's DMI table in a human-readable format. DMI is a standard developed by DMTF and stands for Desktop Management Interface. DMI information includes descriptions of hardware components

such as BIOS, motherboard, processor, memory controllers, port connectors, system slots etc. DMI information should be provided by the component or PC manufacturers, and can often be incomplete and inaccurate.
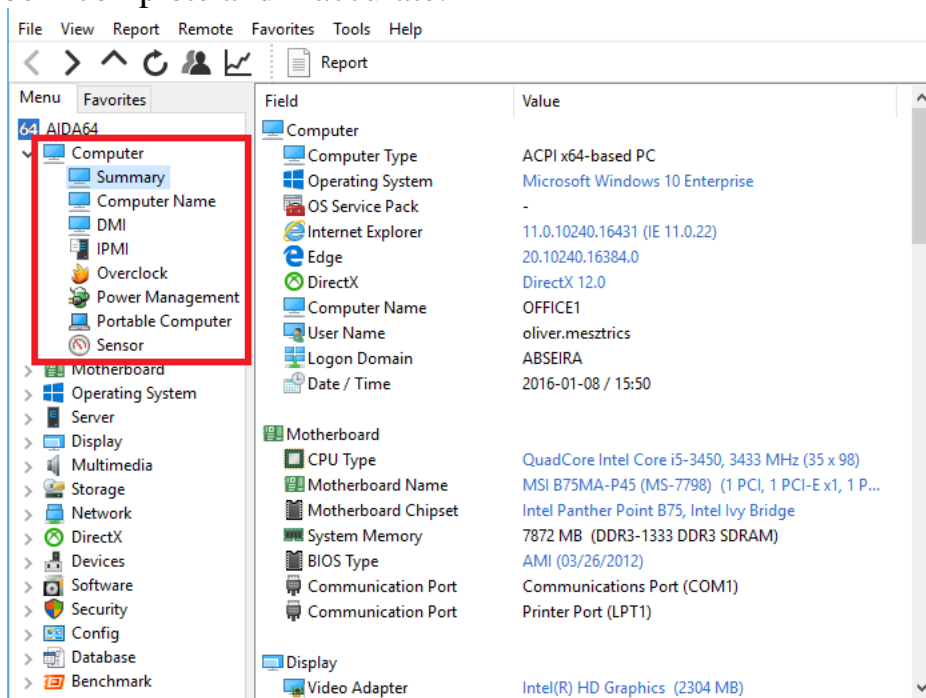

Fig.2. Category "Computer"

1.3.4 IPMI

Here EVEREST HOME EDITION displays the Intelligent Platform Management Interface (IPMI) system log and sensor information.

1.3.5 Overclock

This page displays CPU properties, CPU speed and cache information as well as motherboard, chipset, BIOS and graphics processor properties.

1.3.6 Power Management

This page displays information about the PC's power source and battery (if applicable). Temperature and capacity monitoring, input voltage, output voltage, output current and energy consumption measurements are also provided for HID-capable UPS devices.

1.3.7 Portable computer

This page displays mobile PC related physical information as well as Intel Centrino platform compliance information.

1.3.8 Sensor

This page provides motherboard, CPU and HDD sensor information as well as cooling fan RPM, voltage and power values in real time.

1.4 Motherboard

1.4.1 CPU

This page provides processor-related information, including CPU type, clock speed, multiplier, cache size and packaging. For Intel processors, a link to a page on the manufacturer's website listing the specifications is also provided. Available for each processor core, CPU utilization data is updated in real time.

1.4.2 CPUID

This page displays processor information using the CPUID instruction. Information about the availability of instruction set extensions, security, power management and virtualization features is also provided.

1.4.3 Motherboard

This page displays information about the motherboard, including name, front side bus properties, memory bus properties, chipset bus properties and manufacturer information.

1.4.4 Memory

This page provides memory information, including physical and virtual memory, swap file size and Physical Address Extension (PAE). The page is updated dynamically, which makes it possible for us to check memory utilization and free memory in real time.

1.4.5 SPD

This page provides information about the installed memory modules, including clock speed, timings, voltages. We can get detailed information about each installed module by selecting the appropriate DIMM slot. At the bottom of the page, information about XMP, EPP and AMP memory profiles is also provided.

1.4.6 Chipset

This page provides information about the motherboard chipset (north and south bridge), including memory timings, installed memory modules, supported memory types and integrated graphics and audio controllers.

1.4.7 BIOS

This page displays system and video BIOS information. Asus ATK and Intel XTU are used to provide current BIOS settings.

1.4.8 ACPI

This page displays the Advanced Configuration and Power Interface (ACPI) table properties. On the SLIC table, we can see information about the Windows license, while at the bottom of the DSDT table, we can check NVIDIA SLI and Lucid Virtu certifications.

1.5 Operating system

This page displays operating system information, including Windows version, license information, product key, session statistics and operating system components and features: Processes, System drivers, Services, AX Files, etc.

1.6 Server

1.6.1 Share

This page lists the shared resources on the network (folders, printers). We can open the shares or remove those we do not need.

1.6.2 Opened files

This page lists files and folders opened locally or remotely on the computer together with the name of the user who opened them.

1.6.3 Account security

This page displays information about the security settings and password policy used in the domain.

1.6.4 Logon

This page lists all the users who are currently logged on.

1.6.4 Users

This page lists the domain users. If we do not use a domain local users are listed here. By double-clicking the information window at the top, we can modify user and group settings.

1.6.5 Local Groups

This page lists the local groups. By double-clicking the information window at the top, we can modify the group settings.

1.6.6 Global Groups

This page lists the global groups. By double-clicking the information window at the top, we can modify the group settings.

1.7 Display

This page lists the available graphics adapters and information about the installed drivers. Double-clicking a graphics adapter will load the Windows Display Properties / Screen Resolution window, where we can modify our display settings. Lists the available PCI, AGP and PCI Express graphics adapters, provides detailed GPU information, such as manufacturer, GPU version, GPU clock, number of processing units, fill rate, memory and utilization. If we have more GPUs installed in our PC we can select the one we are interested in. The page is updated dynamically in real time, which enables us to monitor actual clock speeds and utilization. Links to driver download websites are provided at the bottom of the page. On the page "Monitor", we

can review the monitor properties, including physical information and supported video modes. Links to driver download websites are provided at the bottom of the page.

1.8 Multimedia

This page lists the audio devices available in Windows, the PCI / PnP audio devices. Provides details about available High Definition Audio controllers and HD Audio devices. Links to driver download websites are provided at the bottom of the page.

"OpenAL" page displays OpenAL properties and provides information about OpenAL extension support. Note: OpenAL API calls may cause application or operating system faults when the audio driver does not fully conform to industry-accepted standards, therefore it is recommended to disable this page when completing a network audit. Provides information about the available video codecs. Double-clicking on any item will open the "Sound" window, Media Control Interface devices.

1.9 Storage

This page lists the storage devices installed in the system, including SATA, IDE and SCSI controllers and the attached disk drives. Physical information is provided for hard disks, optical drives and SSDs.

1.10 Network

This page enumerates the wired and wireless network adapters installed, such as integrated WLAN controllers, motherboard-integrated LAN controllers and Bluetooth controllers. The page provides network adapter properties, including real-time traffic information. Links to the manufacturers' driver download websites are provided at the bottom of the page.

1.11 Benchmark

EVEREST HOME EDITION offers dedicated microbenchmarks, which are available under the Benchmark category in the Page menu. These are synthetic benchmarks, which means that they can be used to measure the theoretical maximum performance of the system. Memory bandwidth, CPU and FPU benchmarks are built on the multi-threaded EVEREST HOME EDITION benchmark engine that – since EVEREST HOME EDITION Business v4.00 – supports up to 640 simultaneous processing threads and 10 processor groups.

1.12 DATABASE

These pages provide information about the installed database software, such as database servers and driver versions. Further details about the drivers (specifically, ODBC and BDE drivers) are found in the corresponding sub-pages, where we can also find information about the ODBC Data Sources .

2. Task for laboratory work

2.1 Step 1: Download the Everest program. Get acquainted with the window and the main features of the program.

2.1.2 Open the category "Computer". Determine: summary, Computer name, DMI, IPMI, Overclock, Power Management, Portable computer, Sensor.

2.1.3 Open the category Motherboard → Motherboard. Determine the manufacturer's company, ID and type of motherboard.

2.1.4 Determine the bit rate, clock frequency; bandwidth for memory bus, chipset bus, system bus.

2.1.5 Describe the main characteristics of the motherboard:

- Chipset;
- Memory;
- SPD;
- BIOS.

2.1.6 Go to Devices → Physical Devices. Install PCI, PnP, USB, LPT devices.

2.1.7 Go to Devices → Device Resources. Set the interrupt of the main devices.

2.2 Step 2: Perform research for compatible components for your customer.

Your customer already owns the components described in the table 2.1 below.

Table 2.1 – The components of your customer

Component	Brand and Model Number	Features	Cost
Case	NZXT Source 210	ATX Mid Tower 2 x USB 2.0 Front Ports Bottom Mounted PSU Wire Management Support Dual 120mm Front Intake Also fits 2 x 120/140mm fan	$39.99
Motherboard	ASUS H97-PRO Gamer	LGA 1150 Core i7 / i5 / i3 Intel H97 Chipset DDR3 1600/1333 MHz Non-ECC, Un-buffered 32GB Maximum Dual Channel Memory Supported 1 x PCIe 3.0/2.0 x16 1 x PCIe 2.0 x16 2 x PCI Express x1 4 x SATA 6Gb/s 4 x USB 3.0	$104.99
Hard Drive	Western Digital WD5000AAKX	SATA 6.0Gb/s 500GB 7200 RPM 16MB Cache	$52.99

Search the Internet the following components, make sure they are compatible with the components that your customer owns. Enter the specifications in the table 2.2.

Table 2.2 – Specifications the following components

Component	Brand and Model Number	Features	Cost
Power Supply			
CPU			
Heatsink/Fan			
RAM			
Video Adaptor Card			

2.3 Step 3: Make a report on the laboratory work №1. The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

3. Answer the following PC component questions.

3.1 List three components that must have the same compatible form factor.

3.2 List three components that must conform to the same socket type.

3.3 List two components that must utilize the same front side bus speed.

3.4 List three considerations when you choose memory.

3.5 What component must be compatible with every other component of the computer?

Laboratory work №2

Theme: Components on the motherboard.
Aim of the work: to study the main components of the motherboard, which helps us to understand the internal working of a PC.
Equipment: components motherboard.

3. Theoretical information

The motherboard, also known as the system board or the main board, is the backbone of the computer. As shown in the figure, a motherboard is a printed circuit board (PCB) that contains buses, or electrical pathways, that interconnect electronic components. These components may be soldered directly to the motherboard, or added using sockets, expansion slots, and ports (fig 1).
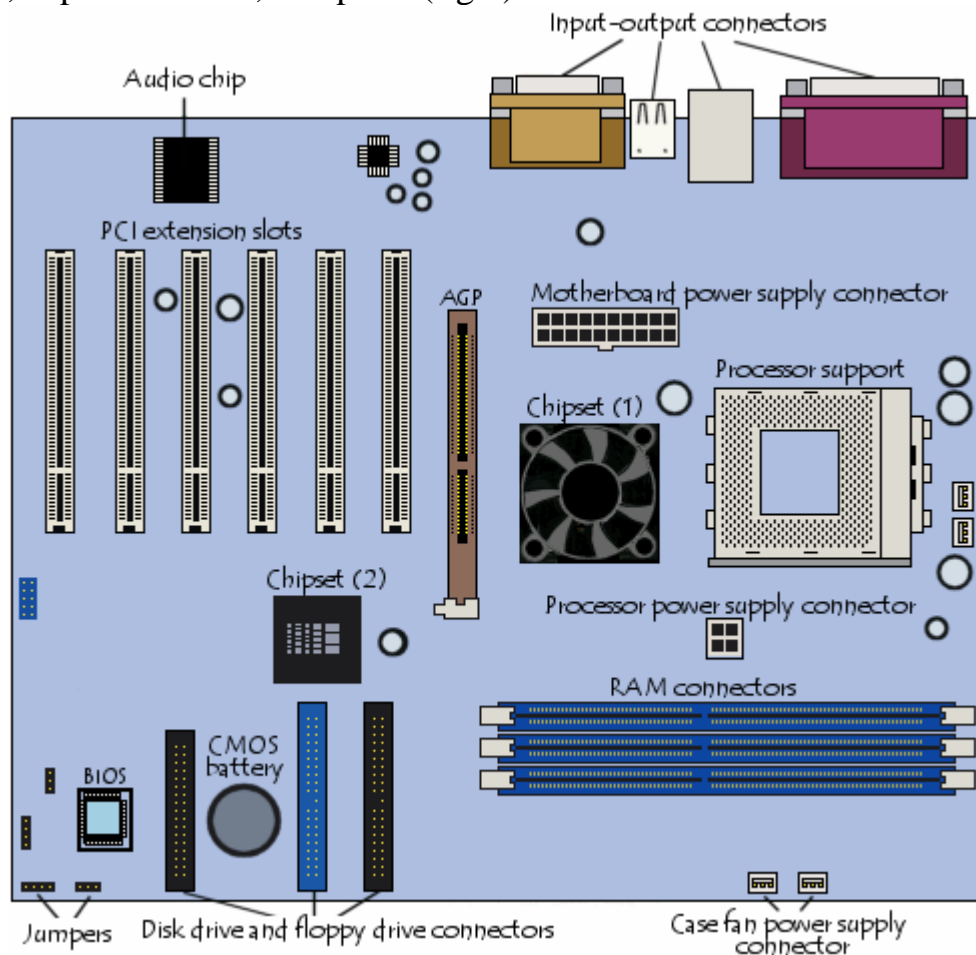
Fig1. Motherboard components

These are some connections on the motherboard where computer components can be added, as shown in the Figure 2:

Central Processing Unit (CPU) - This is considered the brain of the computer.
Random Access Memory (RAM) - This is a temporary location to store data and applications.

Expansion slots - These provide locations to connect additional components.

Chipset - This consists of the integrated circuits on the motherboard that control how system hardware interacts with the CPU and motherboard. It also establishes how much memory can be added to a motherboard and the type of connectors on the motherboard.
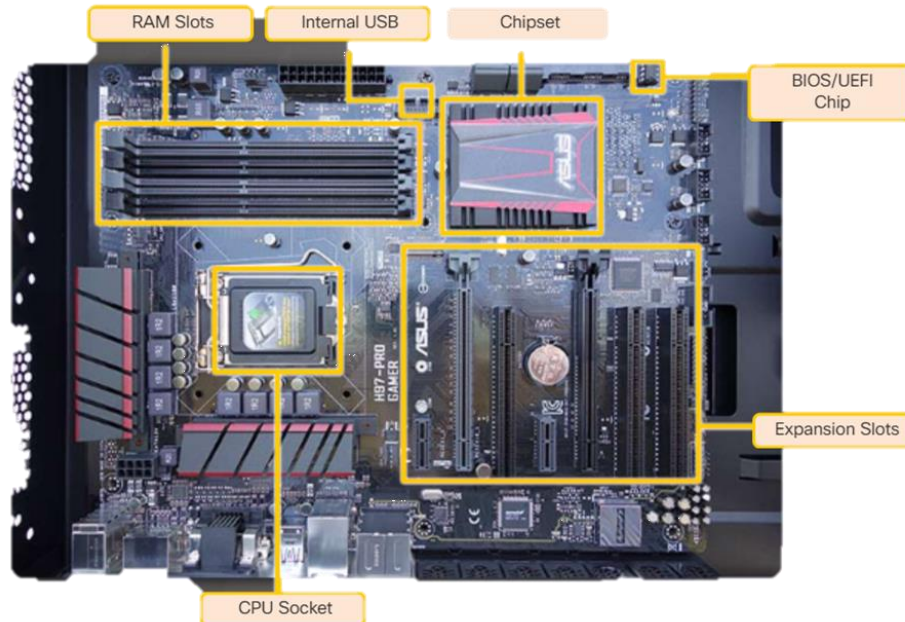
Fig2. Connections on the motherboard

Basic input/output system (BIOS) chip and Unified Extensible Firmware Interface (UEFI) chip - BIOS is used to help boot the computer and manage the flow of data between the hard drive, video card, keyboard, mouse, and more. In modern computers BIOS has been replaced by UEFI. UEFI specifies a different firmware for boot and runtime services. Firmware is programming that allows a computer operating system to control the hardware.

TYPES of Motherboards:
1)   AT
2)   Baby AT
3)   ATX
4)   MINI ATX
5)   MICRO ATX
6)   NLX

The PC/XT was the original form factor introduced by IBM. It only came in desktop form and, though it looked pretty high-tech and streamlined at the time, was fairly large and clunky. They're not made anymore, they were replaced by the AT form factor.

Because technology had advanced somewhat, components were becoming smaller (the evolution continues to this day). Components on the AT motherboard were positioned a little more efficiently, and the size of the power supply was reduced without any loss in performance. The position of the power supply also changed with

the introduction of the tower-style case. Now you could get two different styles of case, the desktop and the tower, with some variation in sizes, as well.

Cooling became much more efficient, with the power supply fan blowing air out the top, and the vent holes near the bottom of the case allowing cooler air to be sucked in. The AT form factor also moved the power switch from the back, or side, to the front of the case (remote power switch). The AT is also not available anymore.

With components becoming increasingly smaller, voltages changing, and chip and component placement becoming more efficient, manufacturers discovered they could make the board smaller. They decreased the width of the AT form factor and introduced the Baby AT. The fact that less material was required to manufacture it, and the introduction of IDE connectors, and other I/O connectors that are integrated directly on to the motherboard, resulted in cheaper production costs. This made the new form factor quite popular with the manufacturer.

The case that conformed to the Baby AT form factor could now become slightly smaller in stature. That made the Baby AT form factor quite popular with the consumer.

Most of the computers above the Pentium MMX have gone away from the Baby AT format, to the ATX. But as long as the Pentiums 200 - 266 remain a useful and plentiful machine, the Baby AT form factor will probably remain available.

The component configuration on the ATX motherboard is fairly similar to the Baby AT. By taking the Baby AT and turning it 90 degrees, the CPU and memory modules become more easily accessible. The Baby AT introduced integrated I/O connectors that attached, via small ribbon cables, to the ports installed on slot-plates at the back of the computer. With The ATX, integration is taken one step further. The different serial, parallel, and USB ports are hardwired directly to the motherboard in a small cluster at the back of the computer.

The power supply connector has changed a bit also. P8 and P9 connectors have been replaced by a single tabbed connector. The remote switch on the ATX is connected to the motherboard, not directly to the power supply, and there is power to the board at all times. The cases come in all the regular sizes and styles. The ATX is currently the most popular form factor out there.

There is a slightly smaller version of the ATX called the Mini ATX. Although the motherboard is slightly more compact, it uses the same case and power supply. I mention it here, only to differentiate between it, and the Micro ATX.

The more compact version of the ATX is called the Micro ATX, and it's targeted toward the low end computer market. The cases generally have about 1 X 5-1/4" bay, 1 X 3.5", and 1 internal bay. The Micro ATX power supply is also smaller, and usually has just enough power for what's already in the computer. There is very little (zero) room for expansion. I think the Micro ATX probably came about as a result of manufacturers competing for that first 'under $1000' computer.
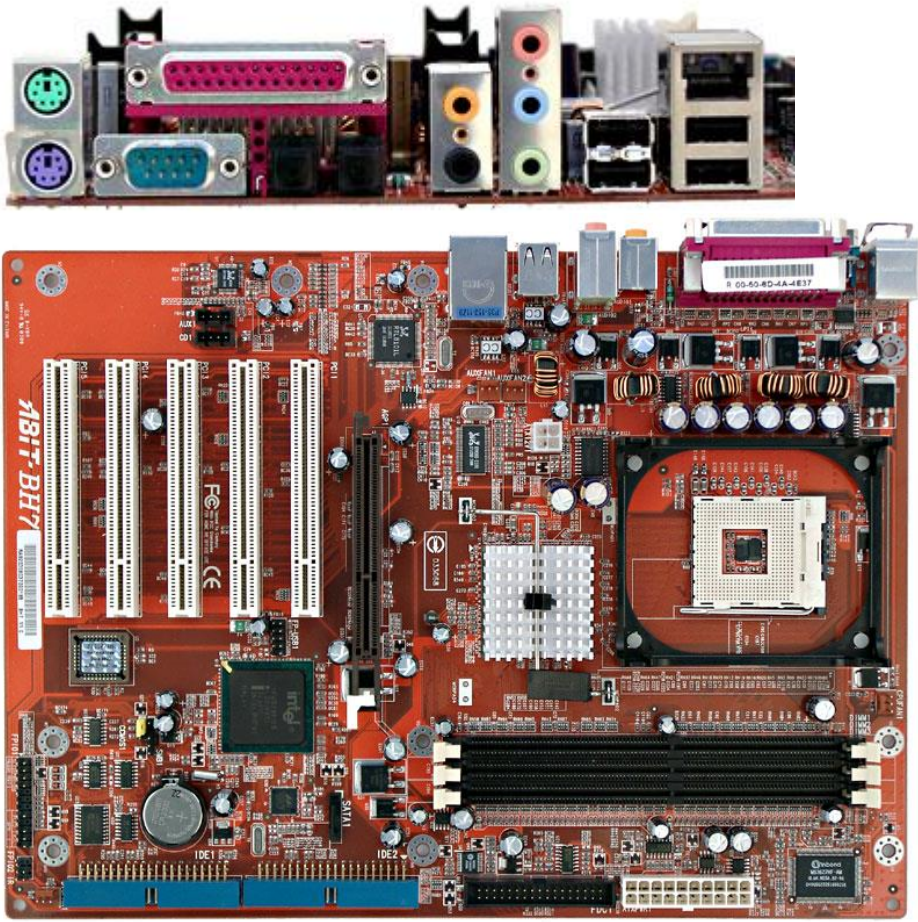
There is another case and MB combination, the NLX that may become more popular than the ATX. Mostly due to the fact that the big name manufacturers use the NLX form factor extensively to mass produce systems at a reduced cost. The NLX has a single expansion slot on the motherboard. There's a riser card that fits into the slot and contains the rest of the expansion slots required by the system. The whole idea is to be

able to make the case narrower, and it does the job. The case is no longer limited by the height of the expansion cards because the expansion cards are installed horizontally. Although NLX is a recognized standard, and the parts are supposed to be interchangeable, they still seem to be quite proprietary. You'll recognize the NLX by the horizontal slot holes at the back of your computer.
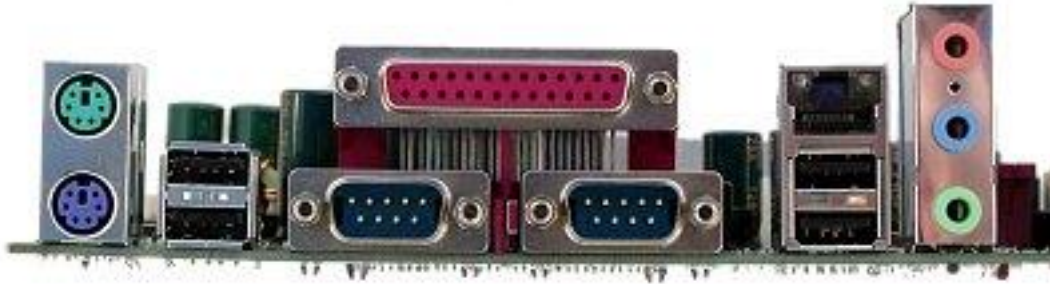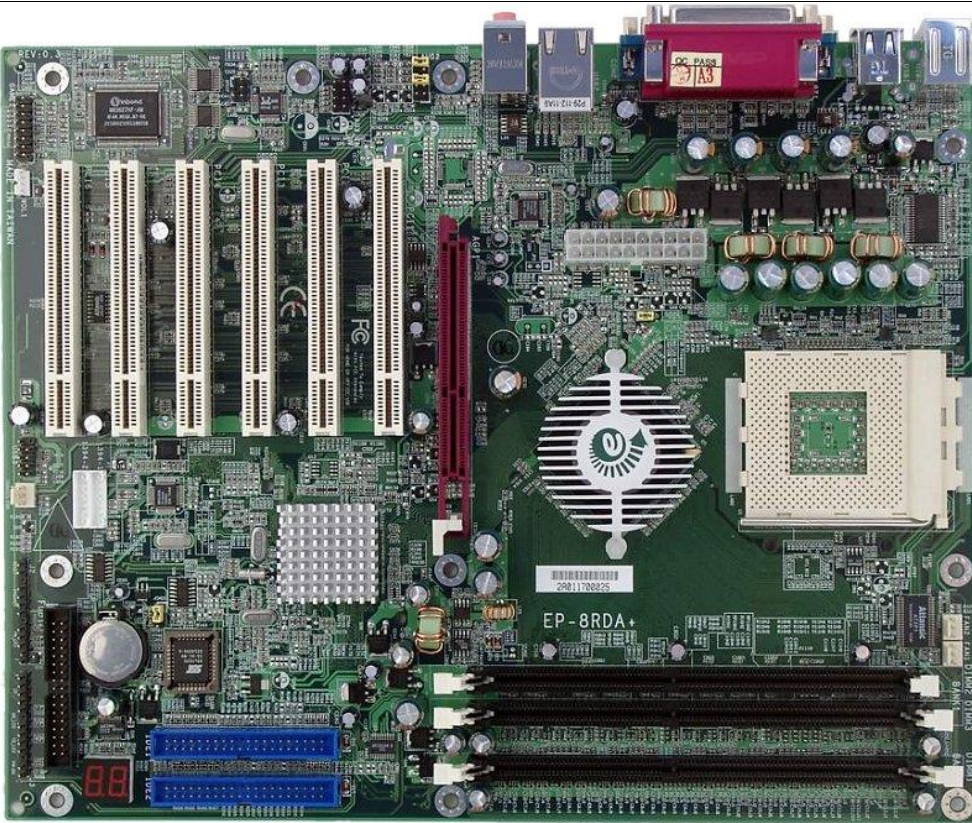
4. Task for laboratory work

2.1 Step 1: Draw a block diagram of the motherboard according to yours variant described in the table 2.1.

Table 2.1 Individual task

Variant	Tasks
1	

2

| 3 | |
| 4 | |

| 5 | |
| 6 | |

| 7 | |
| 8 | |

9	

3. Make a report on the laboratory work №2. The report should be printed on A4 sheets (in the footers indicate: last name, 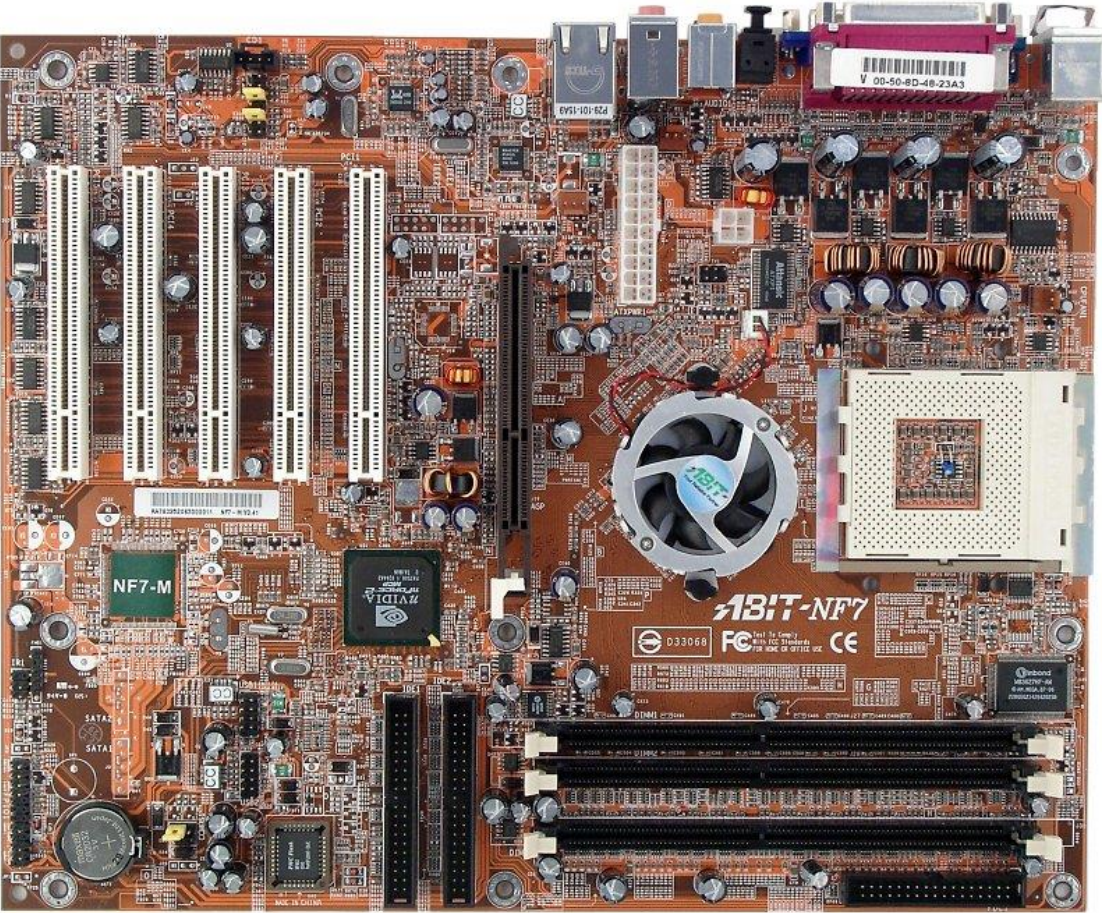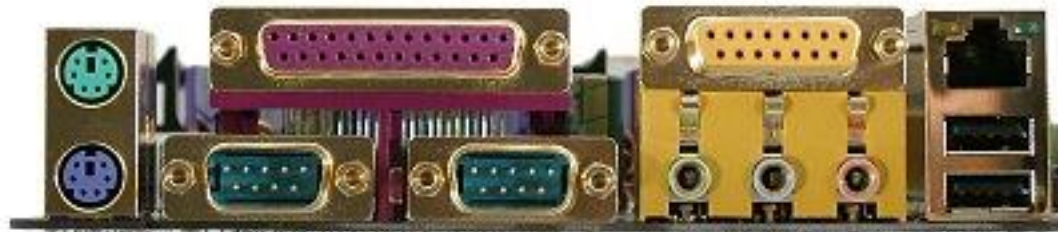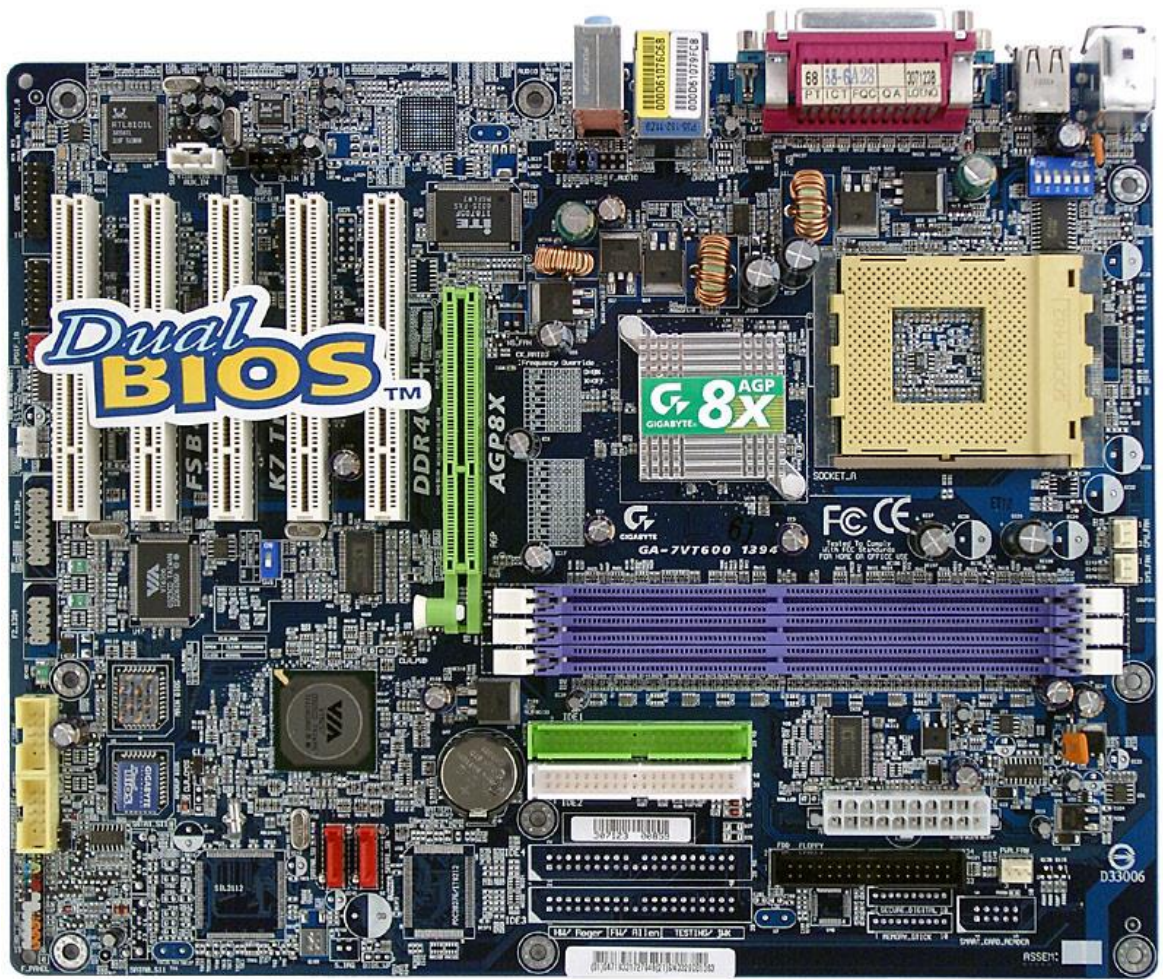first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

4. Answer the following PC component questions.
4.1 List three components that must have the same compatible form factor.
4.2 List three components that must conform to the same socket type.
4.3 List two components that must utilize the same front side bus speed.
4.4 List three considerations when you choose memory.
4.5 What component must be compatible with every other component of the computer?

Laboratory work №3

Theme: Build a Specialized Computer System

Aim of the work: to make choices and analyze information about building a specialized computer system that supports hardware and software that allows a user to perform tasks that an off-the-shelf system cannot perform.

Equipment: computer.

5. Theoretical information

Computer hardware (usually simply called hardware when a computing context is concerned) is the collection of physical elements that constitutes a computer system. Computer hardware is the physical parts or components of a computer, such as the monitor, mouse, keyboard,computer data storage, hard disk drive (HDD), graphic cards, sound cards, memory, motherboard, and so on, all of which are physical objects that are tangible. In contrast, software is instructions that can be stored and run by hardware.

The personal computer, also known as the PC, is one of the most common types of computer due to its versatility and relatively low price. Laptops are generally very similar, although may use lower-power or reduced size components.

The computer case is a plastic or metal enclosure that houses most of the components. Those found on desktop computers are usually small enough to fit under a desk, however in recent years more compact designs have become more common place, such as the all-in-one style designs from Apple, namely the iMac. Though a case can basically be big or small, what matters more is which form factor of motherboard it's designed for. Laptops are computers that usually come in a clamshell form factor, again however in more recent years deviations from this form factor have started to emerge such as laptops that have a detachable screen that become tablet computers in their own right.

A power supply unit (PSU) converts alternating current (AC) electric power to low-voltage DC power for the internal components of the computer. Laptops are capable of running from a built-in battery, normally for a period of hours.

Components directly attached to or part of the motherboard include:

–The CPU (Central Processing Unit) performs most of the calculations which enable a computer to function, and is sometimes referred to as the "brain" of the computer. It is usually cooled by a heat sink and fan. Most newer CPUs include an on-die Graphics Processing Unit (GPU).

–The Chipset, which includes the north bridge, mediates communication between the CPU and the other components of the system, including main memory.

–The Random-Access Memory (RAM) stores the code and data that are being actively accessed by the CPU.

–The Read-Only Memory (ROM) stores the BIOS that runs when the computer is powered on or otherwise begins execution, a process known as Bootstrapping, or "booting" or "booting up". The BIOS (Basic Input Output System) includes boot

firmware and power management firmware. Newer motherboards use Unified Extensible Firmware Interface (UEFI) instead of BIOS.

–Buses connect the CPU to various internal components and to expand cards for graphics and sound.

–The CMOS battery is also attached to the motherboard. This battery is the same as a watch battery or a battery for a remote to a car's central locking system. Most batteries are CR2032, which powers the memory for date and time in the BIOS chip.

Computer data storage, often called storage or memory, refers to computer components and recording media that retain digital data. Data storage is a core function and fundamental component of computers. The price of solid-state drives (SSD), which store data on flash memory, has dropped a lot in recent years, making them a better choice than ever to add to a computer to make booting up and accessing files faster.

Input and output devices are typically housed externally to the main computer chassis. The following are either standard or very common to many computer systems.

Input devices allow the user to enter information into the system, or control its operation. Most personal computers have a mouse and keyboard, but laptop systems typically use a touchpad instead of a mouse. Other input devices include webcams, microphones, joysticks, and image scanners.

Output devices display information in a human readable form. Such devices could include printers, speakers, monitors or a Braille embosser.

When using computer hardware, an upgrade means adding new hardware to a computer that improves its performance, adds capacity or new features. For example, a user could perform a hardware upgrade to replace the hard drive with a SSD to get a boost in performance or increase the amount of files that may be stored. Also, the user could increase the RAM so the computer may run more smoothly. The user could add a USB 3.0 expansion card in order to fully use USB 3.0 devices. Performing such hardware upgrades may be necessary for older computers to meet a programs' system

6. Task for laboratory work

2.1 Step 1: For this worksheet, assume the customer's system will be compatible with the parts you order.

2.1.1 The customer runs an audio and video editing workstation to record and mix music, create music CDs, CD labels, and create home movies. The customer wishes to upgrade the components listed in the table 3.1.

2.1.2 Provide reasons for the components purchased. How will they support the customer's needs?

Table 3.1 – The components to upgrade

Brand and Model Number	Features	Cost
Audio card		
Video card		
Hard drive		
Dual monitors		

2.2 Step 2: The customer runs computer-aided design (CAD) or computer-aided manufacturing (CAM) software and wishes to upgrade the components listed in the table 3.2.

Table 3.2 – The components to upgrade

Brand and Model Number	Features	Cost
CPU		
Video card		
RAM		

2.2.1 Provide reasons for the components purchased. How will they support the customer's needs?

2.3 Step 3: The customer uses virtualization technologies to run several different operating systems to test software compatibility.

2.3.1 The customer wishes to upgrade the components listed in the table 3.3.

Table 3.3 – The components to upgrade

Brand and Model Number	Features	Cost
RAM		
CPU		

2.3.2 Provide reasons for the components purchased. How will they support the customer's needs?

2.4 Step 4: The customer wishes to upgrade a gaming computer with the components listed in the table 3.4.

Table 3.4 – The components to upgrade

Brand and Model Number	Features	Cost
CPU		
Video card		
Sound card		
Cooling system		
RAM		
Hard drive		

2.4.1 Provide reasons for the components purchased. How will they support the customer's needs?

2.5 Step 3: Make a report on the laboratory work №3. The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

3. Answer the following PC component questions.
3.1 What is USB Hub?
3.2. What is HDMI port?
3.3. Can you open the CD/DVD tray if there is no power supply? If yes how?
3.4. Number of cores in Intel Core i5 processor?
3.5. What is FSB?
3.6. What is the purpose of heat sink?
3.7. What motherboard spec affects performance the most?
3.8. What is a tuner card?

Laboratory work №4

Theme: Diagnostic Software
Aim of the work: to make choices and analyze information about a hard drive diagnostic program. Be prepared to discuss the diagnostic software you researched..
Equipment: computer.

7.   Theoretical information

Computer hardware (usually simply called hardware when a computing context is concerned) is the collection of physical elements that constitutes a computer system. Computer hardware is the physical parts or components of a computer, such as the monitor, mouse, keyboard,computer data storage, hard disk drive (HDD), graphic cards, sound cards, memory, motherboard, and so on, all of which are physical objects that are tangible. In contrast, software is instructions that can be stored and run by hardware.

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A power supply unit (PSU) converts alternating current (AC) electric power to low-voltage DC power for the internal components of the computer. Laptops are capable of running from a built-in battery, normally for a period of hours.

8. Task for laboratory work

2.1 Step 1: Based on your research, list at least two different hard drive manufacturers.

_____
_____

2.2 Step 2: Based on your research, choose a hard drive manufacturer. Does this manufacturer offer hard drive diagnostic software to go with their products? If so, list the name and the features of the diagnostic software.

_____
_____
_____
_____

2.3 Step 3: Why do manufacturers offer hard drive diagnostic software? What are the potential benefits of doing so to the manufacturer and/or customer?

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_____

_____

2.4 Step 4: Make a report on the laboratory work №4. The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

3. Answer the following PC component questions.
3.1 What is USB Hub?
3.2. What is HDMI port?
3.3. Can you open the CD/DVD tray if there is no power supply? If yes how?
3.4. Number of cores in Intel Core i5 processor?
3.5. What is FSB?
3.6. What is the purpose of heat sink?
3.7. What motherboard spec affects performance the most?
3.8. What is a tuner card?

Laboratory work №5

Theme: Boot the Computer

Aim of the work: to make boot the computer for the first time, explore the firmware setup utility program, and change the boot order sequence.

Equipment: assembled computer with no operating system installed and motherboard manual

9. Theoretical information

The fundamental purposes of the BIOS are to initialize and test the system hardware components, and to load a boot loader or an operating system from a mass memory device.

The BIOS additionally provides abstraction layer for the hardware, i.e. a consistent way for application programs and operating systems to interact with the keyboard, display, and other input/output devices. Variations in the system hardware are hidden by the BIOS from programs that use BIOS services instead of directly accessing the hardware. Modern operating systems ignore the abstraction layer provided by the BIOS and access the hardware components directly. BIOS software is stored on a non-volatile ROM chip on the motherboard. It is specifically designed to work with each particular model of computer, interfacing with various devices that make up the complementary chipset of the system. In modern computer systems, the BIOS contents are stored on a flash memory chip so that the contents can be rewritten without removing the chip from the motherboard. This allows BIOS software to be easily upgraded to add new features or fix bugs, but can make the computer vulnerable to BIOS root kits.

CMOS is an on-board, battery powered semiconductor chip inside computers that stores information, but more specifically, it is a RAM chip. This information ranges from the system time and date to system hardware settings for your computer.

10. Task for laboratory work

Step 1: Power on the computer.

   a. Plug the power supply cable into an AC wall outlet.

   b. If there is a power switch on the power supply, set the switch to "1" or "on".

   c. Turn on the computer with the power button on the front panel.

   Note: If the computer beeps more than once, or if the power does not come on, notify your instructor.

Step 2: Enter the firmware setup program.

   During POST, press the firmware setup key or key combination. The firmware setup utility program screen will appear.

What is the key or combination of keys used to enter the firmware setup utility program?

_____

Who manufactures the BIOS for your computer?

_____

What is the BIOS version?

_____

Step 3: List the main menu options.

List the main menu options and describe what is monitored in each menu?

_____

_____

Step 4: Find the security settings.

Navigate through each screen to find the security settings.

What security settings and features are available?

_____

_____

Step 5: Find the CPU settings.

Navigate through each screen to find the CPU settings.

What is the CPU speed?

_____

What other information is listed for the CPU?

_____

Step 6: Find the RAM settings.

Navigate through each screen to find the RAM settings.

What is the RAM speed?

_____

What other information is listed for the RAM?

_____

Step 7: Find the hard drive settings.

Navigate through each screen to find the hard drive settings.

What information is listed for the hard drive?

_____

_____

Find the boot order sequence.

Navigate through each screen to find the boot order sequence.

What is the first boot device in the boot order sequence?

_____

How many additional devices can be assigned in the boot order sequence?

_____

Step 8: Set the device boot order settings.

    a. Ensure that the first boot order device is the optical drive.

    b. Ensure that the second boot order device is the hard disk drive.

Why would you change the first boot device to the optical drive?

_____

What happens when the computer boots and the optical drive does not contain bootable media?

_____

Step 9: Find the power management setup or ACPI screen.

Navigate through each screen to find the power management setup screen, or ACPI screen.

What power management settings are available?

_____

_____

Step 10:   Find the PnP settings.

Navigate through each screen to find the PnP settings.

What PnP settings are available?

_____

_____

Step 11:   Find the splash screen settings.

Navigate through each screen to find the splash screen settings.

What splash screen settings are available?

_____

_____

Step 12:   Save and exit the setup utility program.

Save the new BIOS/UEFI settings and exit the setup utility program. The computer should restart automatically.

Note: An error message stating that an OS cannot be found (or a similar error) will appear on the screen after the computer boots. An operating system must now be installed to prevent this error. It is safe to turn off the computer at this time.

Step 13: Make a report on the laboratory work №5. The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

3. Answer the following PC component questions.

3.1 Can we upgrade BIOS? If your answer yes: How we can do it?

3.2. A technician has installed a new second hard drive in a tower computer, but the drive does not show up in the BIOS. What are two things the technician should check first?

3.3. technician is troubleshooting a 4-year-old computer that takes a long time to boot, and identifies that the BIOS rediscovers all the hardware at every boot. What action would fix this problem?

3.4. Define the main menu items Setup Bios

3.5. What is the menu item Standart Cmos Setup?

3.6. What is the menu Bios Features Setup?

3.7. How to disable integrated motherboard components?

3.8. How to set a password on the system?

Laboratory work №6

Theme: BIOS Setup Utility and Common Trouble Shooting
Aim of the work: to Understand the BIOS Setup Utility.
Equipment: computer and system BIOS Setup

11. Theoretical information

The BIOS Setup Program or CMOS Setup Program is the System configuration and setup program which runs from System BIOS. It is a menu-driven program. It enables us to configure the motherboard and chipset settings, date and time, passwords, disk drives, Boot options and many other basic system settings. The configurations done by BIOS Setup Utility are stored in a special CMOS RAM.

The BIOS Setup Utility can be activated only by pressing a special key or key combinations during the POST. The correct key to press is normally displayed onscreen during POST. The key or Key combinations used by major BIOS vendors are:

- AMI BIOS – Press F1 or Del during POST
- Phoenix BIOS – Press F1 or F2 during POST
- Award BIOS – Press Del or Ctrl+Alt+Esc during POST

On newer Intel Motherboard based PCs, press F2 to enter BIOS Setup program.

BIOS Setup MenusA typical Setup menu is shown in the figure 1. This menu includes: Main, Advanced, Security, Power, Boot and Exit.
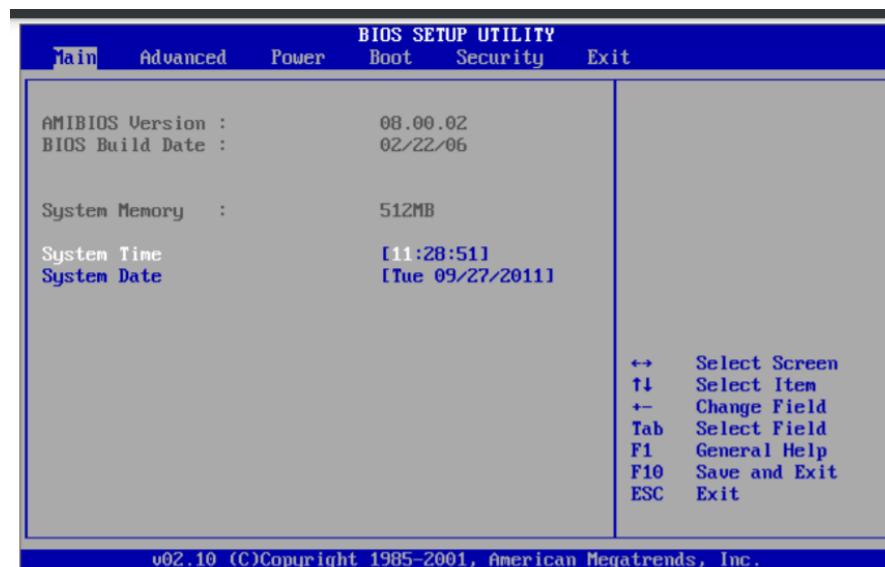
Figure 1 – Main Menu of BIOS Setup

The fundamental purposes of the BIOS are to initialize and test the system hardware components, and to load a boot loader or an operating system from a mass memory device.

The BIOS additionally provides abstraction layer for the hardware, i.e. a consistent way for application programs and operating systems to interact with the keyboard,

display, and other input/output devices. Variations in the system hardware are hidden by the BIOS from programs that use BIOS services instead of directly accessing the hardware. Modern operating systems ignore the abstraction layer provided by the BIOS and access the hardware components directly. BIOS software is stored on a non-volatile ROM chip on the motherboard. It is specifically designed to work with each particular model of computer, interfacing with various devices that make up the complementary chipset of the system. In modern computer systems, the BIOS contents are stored on a flash memory chip so that the contents can be rewritten without removing the chip from the motherboard. This allows BIOS software to be easily upgraded to add new features or fix bugs, but can make the computer vulnerable to BIOS root kits.

CMOS is an on-board, battery powered semiconductor chip inside computers that stores information, but more specifically, it is a RAM chip. This information ranges from the system time and date to system hardware settings for your computer.

12.   Task for laboratory work

2.1 Boot your computer.

During POST, BIOS information is displayed on the screen for a short period of time (fig.1).


```
AMIBIOS(C)2001 American Megatrends, Inc.
BIOS Date: 08/14/03 19:41:02  Ver: 08.00.02

Press DEL to run Setup
Checking NVRAM..

1024MB OK
Auto-Detecting Pri Master..IDE Hard Disk
Auto-Detecting Pri Slave...Not Detected
Auto-Detecting Sec Master..CDROM
Auto-Detecting Sec Slave...Not Detected
```

Figure 1 – POST SETUP

Do not log on to Windows.

What key or combination of keys is used to run Setup on your computer?

_____

12.2   Restart your computer and enter Setup.

The BIOS Setup Utility or UEFI screen appears.

Who is the manufacturer of the BIOS?

_____

Which BIOS version is installed in your computer?

_____

12.3   Search the Internet to find the most current version of BIOS for the motherboard.

Use the information from the previous step to search the Internet to find the most current version of the BIOS for the motherboard in your computer. The following screen is an example of the type of information you would look for to answer the questions below.

Caution: Do not update your BIOS at this time.

What is the current BIOS version available for the motherboard?

_____

What features, if any, have been added to the new BIOS version?

_____

What changes, if any, have been made to the new BIOS version to fix problems?

_____

What are the instructions to update the new BIOS version?

_____

2.4 Complete an individual task in table 1.

Variant	Task
1	Describe the "Time option", indicating its purpose and to which point it refers. In Time, change the time to 01:42:01 and take a screenshot. Describe the Extended Drive option, indicating its purpose and to which point it refers. Under Extended Drive, change the data and take a screenshot.
2	Describe the Type option, indicating its purpose and to which point it refers. Under Type, change the data and take a screenshot. Describe the Access Mode option, indicating its purpose and to which point it refers. In Access Mode, change the data and take a screenshot.
3	Describe the LBA Mode option, indicating its purpose and to which point it refers. In LBA Mode, change the data and take a screenshot. Describe the Cyl option, indicating its purpose and to which point it

	refers. At Cyl, change the data and take a screenshot.
4	Describe the System Time option, indicating its purpose and to which point it refers. At System Time, change the time to 23:10:58 and take a screenshot. Describe the Extended IDE Drive option, specifying its purpose and to which point it refers. Under Extended IDE Drive, change the data and take a screenshot.
5	Describe the LBA / Large Mode option, indicating its purpose and to which point it refers. In the LBA / Large Mode item, change the data and take a screenshot. Describe the Cylinders option, indicating its purpose and to which point it refers. In Cylinders, change the data and take a screenshot.
6	Describe the HD option, indicating its purpose and to which point it refers. In HD, change the data and take a screenshot. Describe the Cyls option, indicating its purpose and to which point it refers. Under Cyls, change the data and take a screenshot.
7	Describe the WPcom option, indicating its purpose and to which point it refers. At WPcom, change the data and take a screenshot. Describe the Landing Zone option, indicating its purpose and to which point it refers. In the Landing Zone, change the data and take a screenshot.
8	Describe the IDE HDD Auto-Detection option, indicating its purpose and to which point it refers. In the IDE HDD Auto-Detection item, change the data and take a screenshot. Describe the Drive A option, indicating its purpose and to which point it refers. In Drive A, change the data and take a screenshot.
9	Describe the AGP 3.0 Speed option, indicating its purpose and to which point it refers. Under AGP 3.0 Speed, change the data and take a screenshot. Describe the Power Button Function option, indicating its purpose and to which point it refers. Under Power Button Function, change the data and take a screenshot.

3 Make a report on the laboratory work №6. The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

4. Answer the following PC component questions.

4.1 Can we upgrade BIOS? If your answer yes: How we can do it?

4.2. A technician has installed a new second hard drive in a tower computer, but the drive does not show up in the BIOS. What are two things the technician should check first?

4.3. Technician is troubleshooting a 4-year-old computer that takes a long time to boot, and identifies that the BIOS rediscovers all the hardware at every boot. What action would fix this problem?

4.4. Define the main menu items Setup Bios

4.5. What is the menu item Standart Cmos Setup?

4.6. What is the menu Bios Features Setup?

4.7. How to disable integrated motherboard components?

4.8. How to set a password on the system?

4.9 Which menu item can be used to change the system configuration?

4.10 What features can the user use when exiting Setup?

Laboratory work №7

Theme: Configure Computer Network

Aim of the work: to configure an Ethernet NIC to use DHCP to obtain an IP address and test connectivity between two computers and , investigate the availability of wireless networks, and test connectivity.

Equipment: computer and operation system and wireless router.

13.   Theoretical information

In the 1990s, internet speeds were slow compared to today, which now has the bandwidth to transmit voice and video, as well as data. A dial-up connection requires either an internal modem installed in the computer or an external modem connected by USB. The modem dial-up port is connected to a phone socket using an RJ-11 connector. Once the modem is physically installed it must be connected to one of the computer's software COM ports. The modem must also be configured with local dialing properties such as the prefix for an outside line and the area code.

The Set Up a Connection or Network Wizard is used to configure a link to the ISP server.Connecting to the internet has evolved from analog telephone to broadband:

Analog telephone internet access can transmit data over standard voice telephone lines. This type of service uses an analog modem to place a telephone call to another modem at a remote site. This method of connection is known as dialup.

Integrated Services Digital Network (ISDN) uses multiple channels and can carry different types of services; therefore, it is considered a type of broadband. ISDN is a standard that uses multiple channels to send voice, video, and data over normal telephone wires. ISDN bandwidth is larger than traditional dialup.

Broadband uses different frequencies to send multiple signals over the same medium. For example, the coaxial cables used to bring cable television to your home can carry computer network transmissions at the same time as hundreds of TV channels. Your cell phone can receive voice calls while also using a web browser.

The Institute of Electrical and Electronic Engineers' (IEEE) standards for Wi-Fi as specified in the 802.11 collective group of standards that specify the radio frequencies, speeds, and other capabilities for WLANs. Various implementations of the IEEE 802.11 standards have been developed over the years, as shown in the figure.

The 802.11a, 802.11b, and 802.11g standards should be considered legacy. New WLANs should implement 802.11ac devices. Existing WLAN implementations should upgrade to 802.11ac when purchasing new devices.

14.   Task for laboratory work

2.1 Configure a NIC to Use DHCP in Windows

2.1.1. Connect the hosts to the router.

For **Host A**, plug one end of the Ethernet patch cable into **Port 1** of the router.

For **Host A**, plug the other end of the Ethernet patch cable into the **network** port on the computer.

For **Host B**, plug one end of the Ethernet patch cable into **Port 2** on the back of the router.

For **Host B**, plug the other end of the Ethernet patch cable into the **network** port on the computer.

Plug in the power cable of the router, if it is not already plugged in.

Turn on both computers and log on to Windows on **Host A** as an **administrator**.

Click **Control Panel > Network and Sharing Center**. The **Network and Sharing Center** window opens.
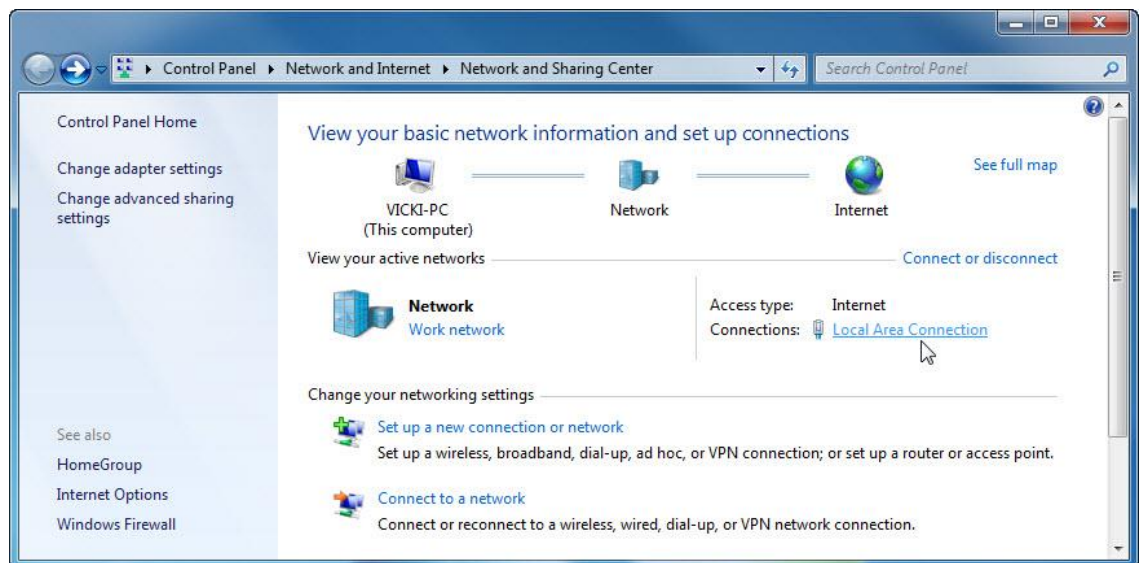
2.1.2 Set Host A's NIC to use DHCP.

Click **Local Area Connection > Properties**. The **Local Area Connection Properties** window opens.
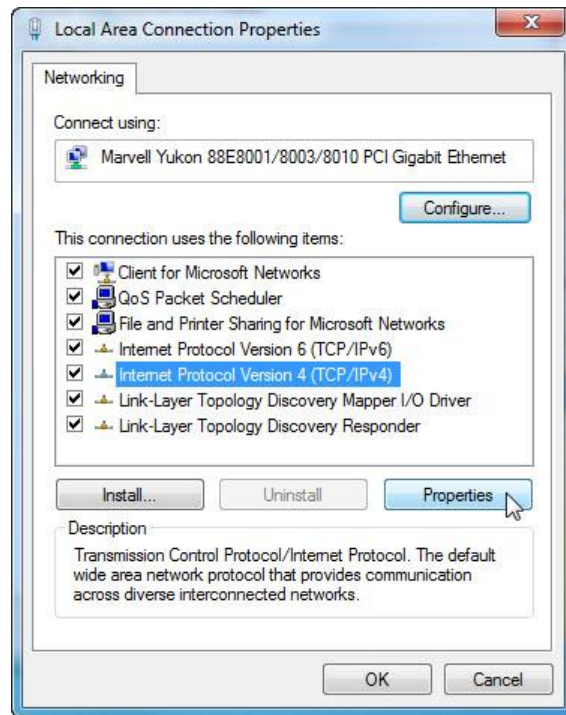
What is the name and model number of the NIC in the **Connect using:** field?

_____

What are the items listed in the **This connection uses the following items:** field?

_____

2.1.3 Click **Internet Protocol Version 4 (TCP/IPv4) > Properties**. The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.
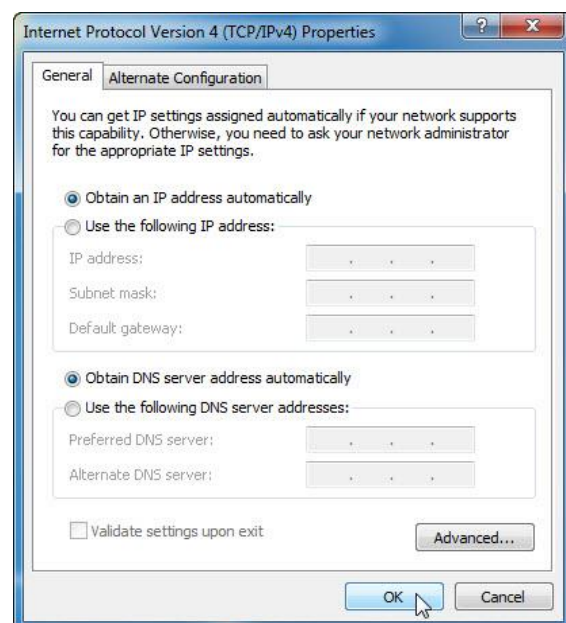
What is listed for the IP address, Subnet mask, and Default gateway in the fields of the **Use the following IP address:** area?

_____

a. Select the **Obtain an IP address automatically** radio button, if it is not already selected.

b. Select the **Obtain DNS server address automatically** radio button, if it is not already selected.

c. Click **OK** to close the **Internet Protocol Version 4 (TCP/IPv4) Properties** window.
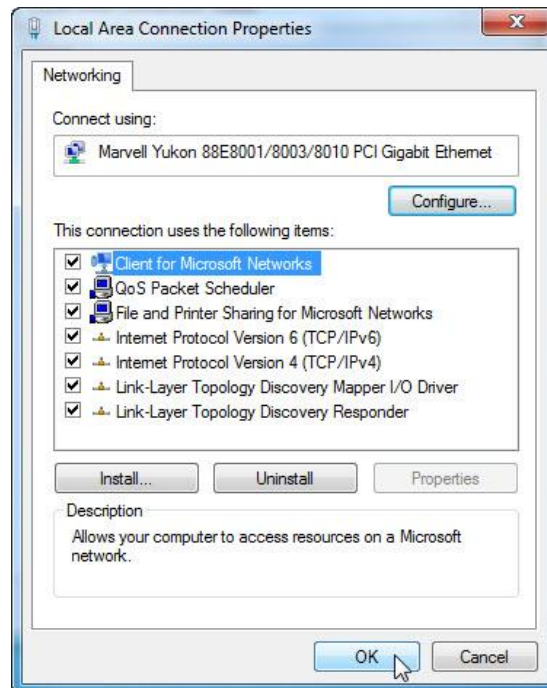
d. Click **OK** to close the **Local Area Connection Properties** window.
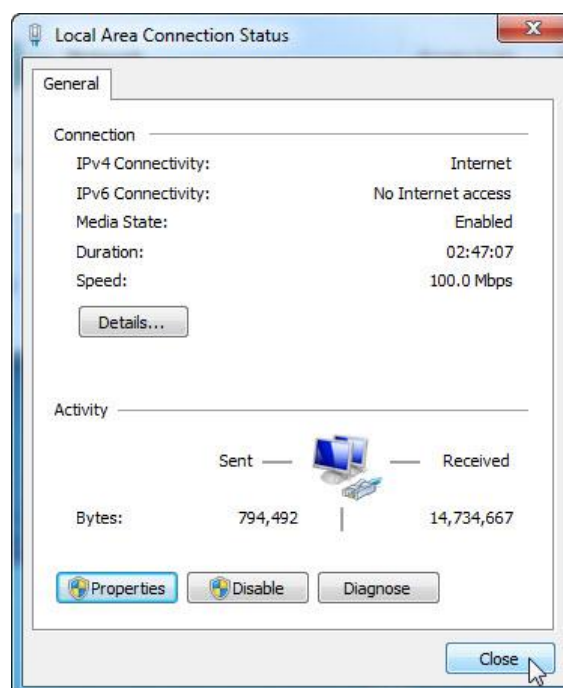
e. Click **Close** to close the **Local Area Connection Status** window.

2.1.6 Record Host A's IP address information.

Check the lights on the back of the NIC. These lights will blink when there is network activity.

Open a command window.

Type **ipconfig /all**, and then press the **Enter** key.

```
C:\Windows\system32\cmd.exe

Microsoft Windows [Version 6.1.7600]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\Vicki>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : Vicki-PC
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : va.shawcable.net

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : va.shawcable.net
   Description . . . . . . . . . . . : Marvell Yukon 88E8001/8003/8010 PCI Gigab
it Ethernet Controller
   Physical Address. . . . . . . . . : 00-11-2F-BD-08-C4
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::54c7:9580:7107:3514%11(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.112(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Sunday, November 21, 2010 11:12:38 AM
   Lease Expires . . . . . . . . . . : Monday, November 22, 2010 11:12:38 AM
   Default Gateway . . . . . . . . . : 192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DHCPv6 IAID . . . . . . . . . . . : 234885423
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-14-67-04-99-00-11-2F-BD-08-C4

   DNS Servers . . . . . . . . . . . : 64.59.144.18
                                       64.59.144.19
                                       64.59.150.133
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

What is the IP address of the computer? _____

What is the subnet mask of the computer? _____

What is the default gateway of the computer? _____

What are the DNS servers for the computer? _____

What is the MAC address of the computer? _____
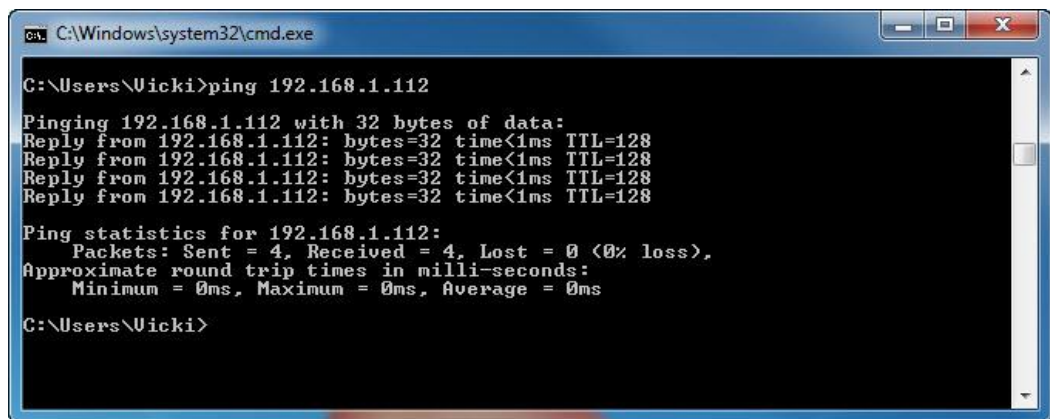
Is DHCP enabled? _____

What is the IP address of the DHCP server? _____

On what date was the lease obtained? _____

On what date does the lease expire? _____

2.1.7 Type **ping** *your IP address*. For example, **ping 192.168.1.112**.

Record one of the replies from your ping command.

_____

If the ping was not successful, ask the instructor for assistance.

2.2 Record Host B's IP address information.

2.2.7 Log in to **Host B** as an administrator and ensure the **Obtain an IP address automatically** and the **Obtain DNS server address automatically** radio buttons are selected.

2.2.8 Click **OK > OK**.

2.2.9 Open a command window.

2.2.10   Type **ipconfig /all**.

What is the IP address of the computer? _____

What is the subnet mask of the computer? _____

What is the default gateway of the computer? _____

What are the DNS servers for the computer? _____

What is the IP address of the DHCP server? _____

2.3 Set static IP address information.

2.3.7 Select the radio buttons **Use the following IP address** and **Use the following DNS server address**.

2.3.8 Enter in the IP address information for the NIC from the previous step.

2.3.9 Click **OK > OK**.

2.3.10   Open a command window.

2.3.11   Type **ping** *IP address for Host B*.

If the ping was not successful, ask the instructor for assistance.

2.4 Verify Connectivity.

2.4.7 From **Host B**, type **ping** *IP address for Host A*.

Was the ping successful? _____

2.4.8 From **Host A** type **ping** *IP address for Host B*.

Was the ping successful? _____

2.4.9 Return all network configurations to their original settings, unless stated otherwise by the instructor.

2.4.10 Set the NIC to **Obtain an IP address automatically** and **Obtain DNS server address automatically**.

2.4.11 Click **OK** > **OK**.

2.6 Configure Wireless Router in Windows

2.6.1 Gathering Information

Ask the instructor for the following information:

Router IP Information (IP address and subnet mask): _____

Router name: _____

DHCP Server Information (start IP address and maximum number of hosts): _

Static DNS 1 (optional): _____

SSID: _____

Channel number: _____

Router Username/Password: _____

Wireless Security (passphase key): _____

Note: Only use configurations assigned by the instructor.

2.6.2 Connecting to the Wireless Router

2.6.2   Plug in the power of the wireless router. Boot the computer and log in as an administrator.

2.6.3   Connect the computer to one of the **Ethernet** ports on the wireless router with an Ethernet patch cable.

> **Note**: If this is the first time connecting to the lab router, you must set the network location in Windows.

2.6.4   Open the command prompt. Type **ipconfig /renew** to force the computer to request an IP address from the wireless router via DHCP.

What is the IP address of the default gateway for the computer?

_____

What device took the role of default gateway?

_____

_____

a)   Logging into the Wireless Router

a)   Open a web browser, type the IP address of your default gateway in the URL field, and then press **Enter**.

b)   The **Windows Security** window opens. Type the password provided by the instructor in the **Password** field then click **OK**.

b)   Configuring Basic IP Information

2.6.b.1   The Setup screen opens. Using the information provided by the instructor in **Step 1**, fill in the fields under **Router Address** and **DHCP Server Setting.** The information includes **IP Address**, **Subnet Mask**, **Router Name**, **Start IP Address**, and **Maximum Number of Users**. Click **Save Settings** to save the changes.

c) The **Your settings have been successfully saved. A system reboot is in progress and may take up to 60 seconds** message is displayed.
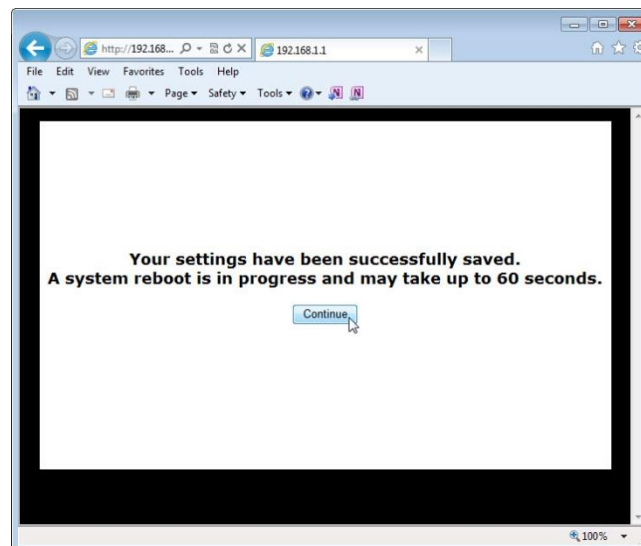
d) Click **Continue** and wait for the wireless router boot process to complete before proceeding. After the router reboots, you may need to log back into it using the router IP address that was configured in this step.

2.6.5 Configuring Wireless Settings

a) In a web browser, enter the router IP address that you had configured in step 4 in the URL field. When prompted, enter the username and password.

b) Click the **Wireless** tab.

c) Click the **Network Mode** drop-down menu for the **5 GHz Wireless Settings**.
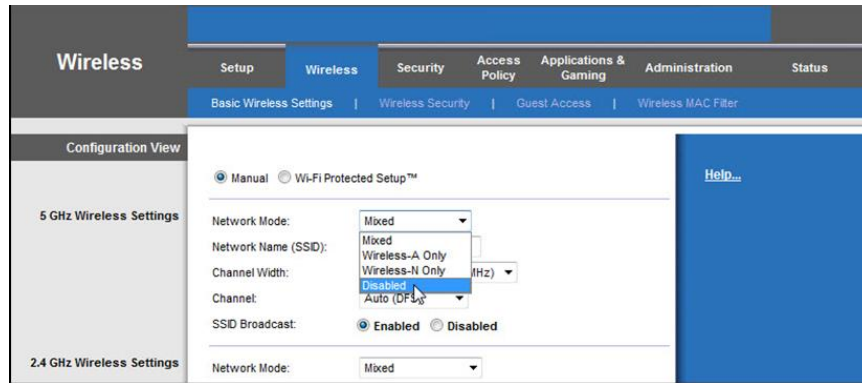
What 802.11 technologies are supported?

_____

d)   Click the **Channel** drop-down menu under **5 GHz Wireless Settings**.
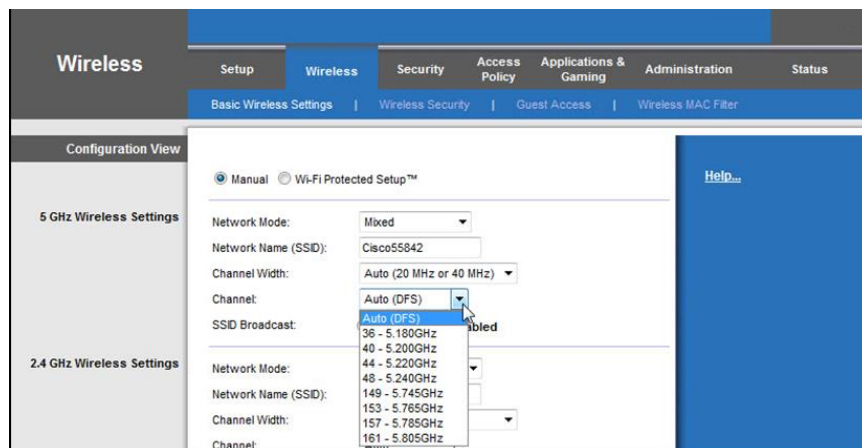
What channels are listed?

_____

e) Disable **Network Mode** for the **5 GHz Wireless settings**.

f) Click the **Network Mode** drop-down menu under 2.4GHz Wireless Settings.

What 802.11 technologies are supported?

_____

i. Choose **Mixed** in the **Network Mode** drop-down menu.

What is the default SSID for the wireless router?

_____

ii. Type **Cisco#** in the **Network Name (SSID)** field, where # is the number assigned by the instructor.

iii. Click the **Channel** drop-down menu for the **2.4GHz Wireless Settings**.

What channels are listed?

_____

iv. Select the Channel number that was provided by the instructor.

v. Click **Save Settings > Continue**, then close the browser.

2.6.6 Connecting the Computer to the Wireless Network

a) Unplug the Ethernet cable from the computer.

b) View wireless networks associated with the wireless adapter configured for the computer by following the path:

**Start > Control Panel > Network and Sharing Center > Connect to a network**
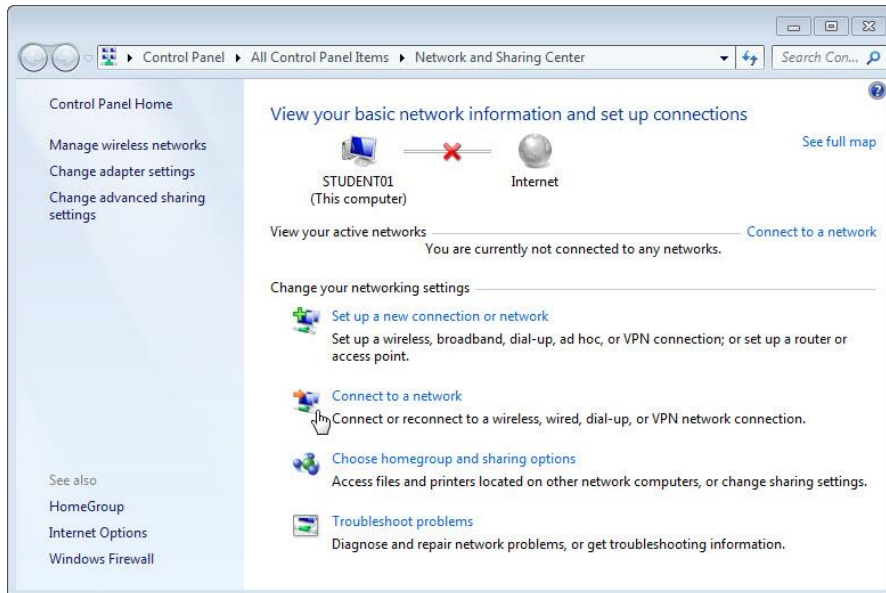
A list of available wireless networks is displayed.
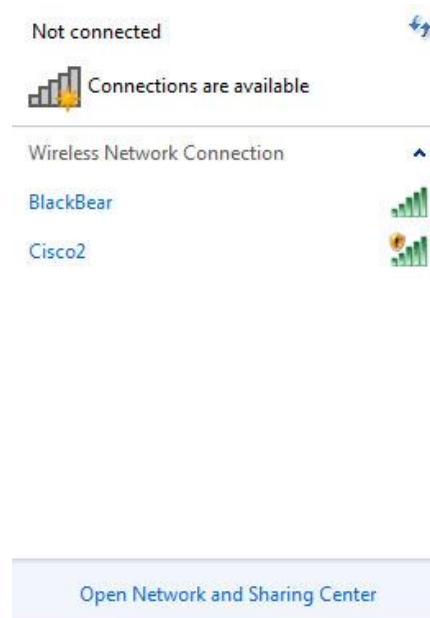
What wireless network(s) are available?

_____

c) Choose **Cisco#**, where # is the number assigned by the instructor, make sure **Connect automatically** is selected, and then click the **Connect** button.
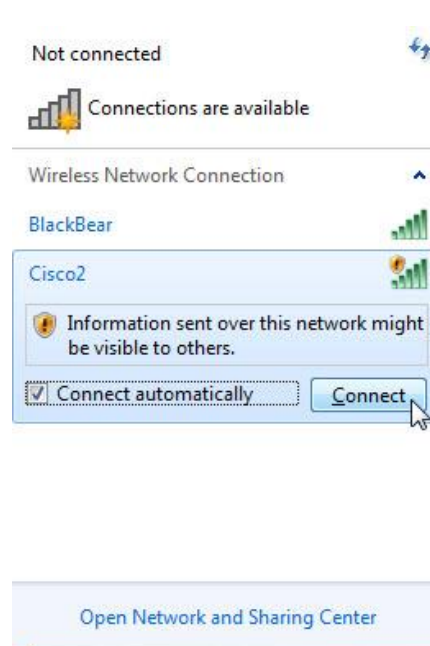
When the **Set Network Location** window opens, select **Public network > Close**.

Hiding the SSID

Open a browser. Type the IP address of your default gateway in the URL field, and then press **Enter**.

The **Windows Security** window opens. Type the password provided by the instructor in the **Password**: field.

The Setup screen opens. Navigate to **Basic Wireless Settings**. Select **Disable** for the 2.4 GHz SSID broadcast**.**
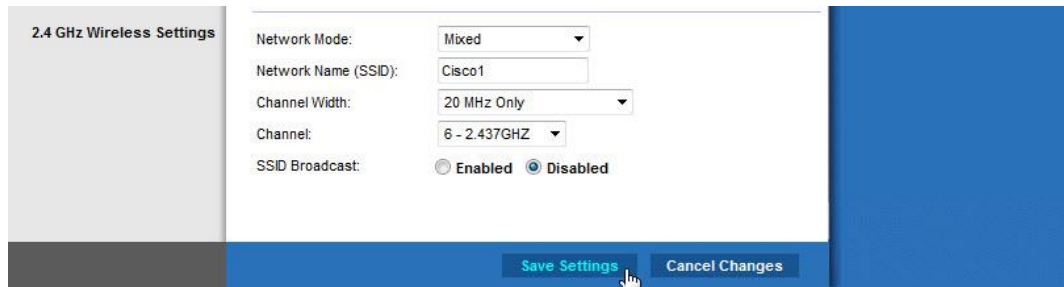
> iii. Click **Save Settings > Continue**.

Why would you disable SSID broadcast?

_____
_____

Close all open windows.

View wireless networks associated with the wireless adapter configured to the computer by following the path:

Start > Control Panel > Network and Sharing Center > Connect to a network
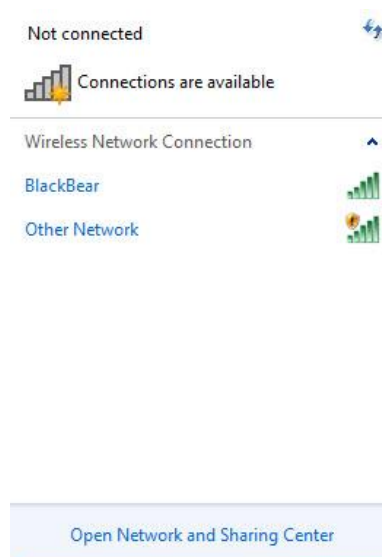
What wireless network(s) are available?

_____

Because the wireless router is not broadcasting the SSID, the wireless network name does not appear in the wireless networks list detected by **Windows**. To connect **Windows** to a wireless network that does not broadcast its SSID, the SSID you must know the wireless network's SSID.

Go back to **Network and Sharing Center**. If **Network and Sharing Center** is no longer open, open it again.

Click **Manage wireless networks**.
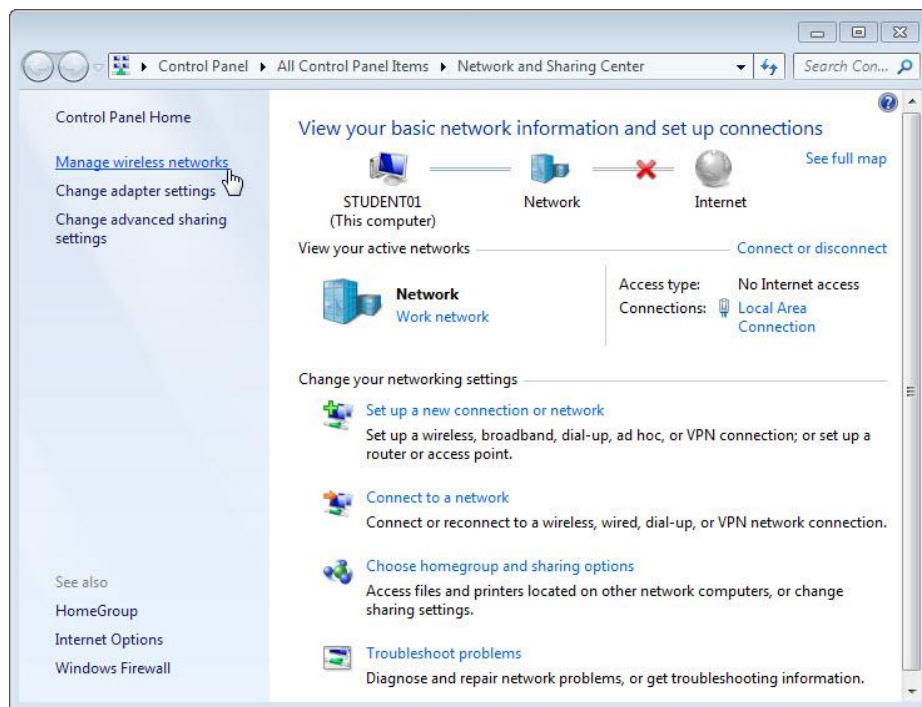
When the **Manage Wireless Networks** window opens, double click **Cisco#**, where # is the number assigned to you.

Note: The wireless router is currently configured to not broadcast the wireless network SSID. The reason why it appears in this list is that the **Cisco#** network was added to this computer before.
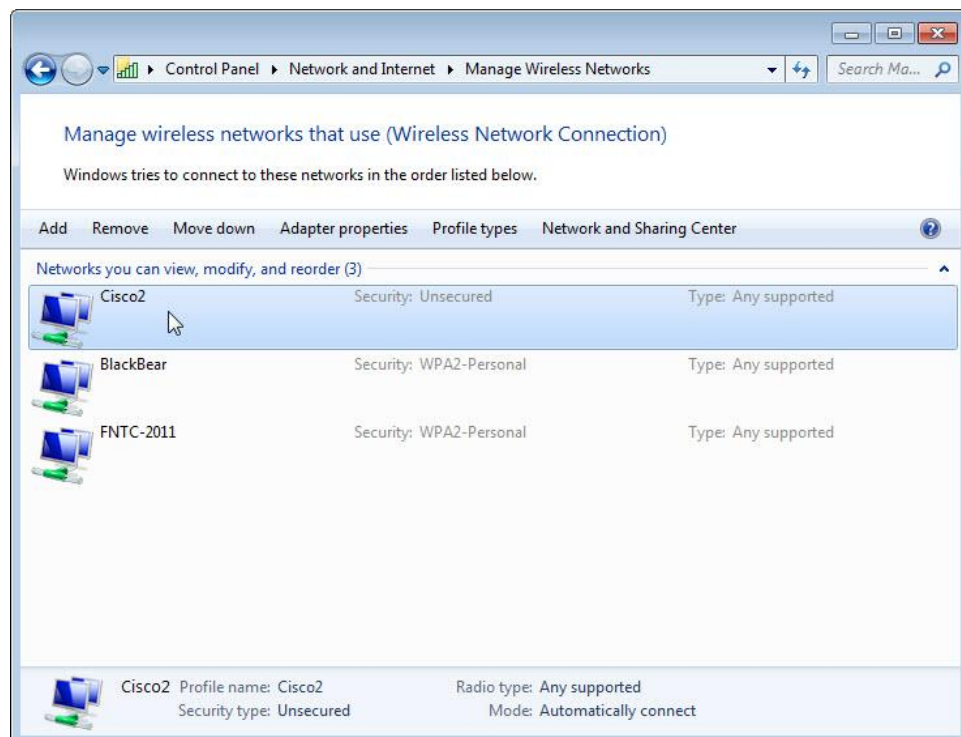
Select the check box **Connect even if the network is not broadcasting its name (SSID)**, then click **OK**.
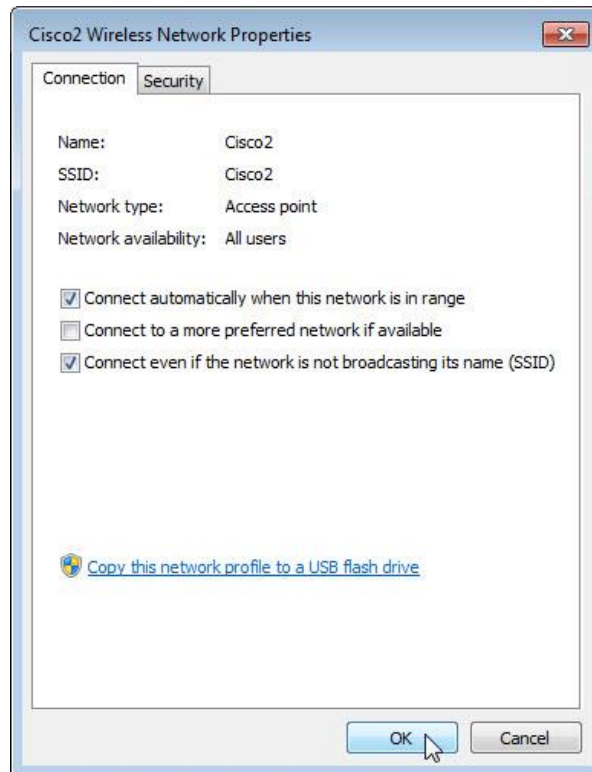
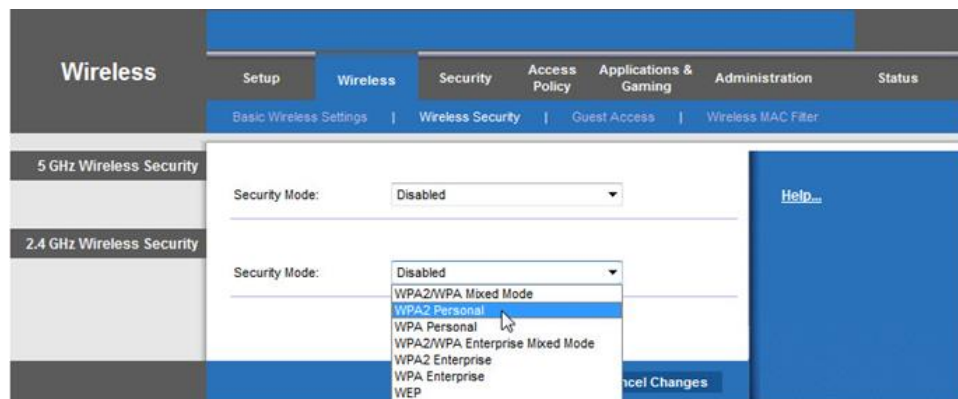View wireless networks associated with the wireless adapter configured for the computer.
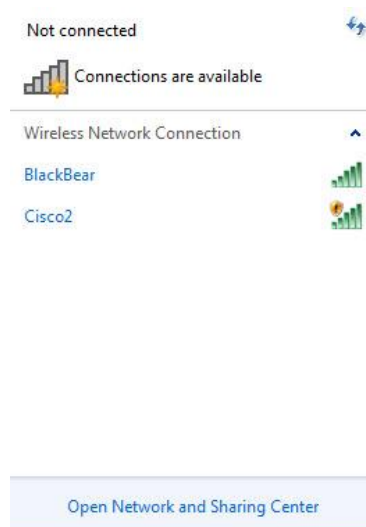
What wireless network(s) are available?

_____

### 2.6.7 Adding Security to the Wireless Network

2.6.7.1 Connect to **Cisco#**, where # is the number assigned by the instructor and log into the router using a web browser.

2.6.7.2   Click the **Wireless** tab and then select **Wireless Security**.

2.6.7.3   In the **Security Mode** drop-down box, for the **2.4GHz Wireless Security**, select **WPA2 Personal**.

2.6.7.4   Type **ITEv6.0!** for the Passphrase and click **Save Settings > Continue**.
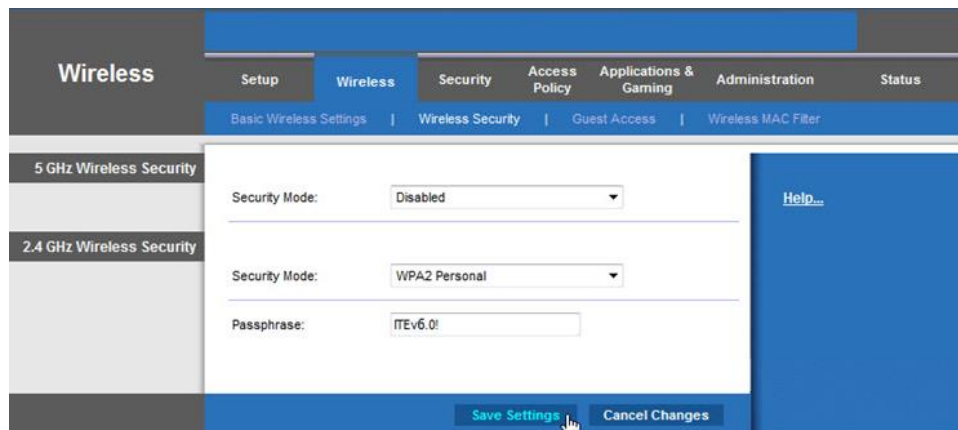
You should have lost connection to the wireless router. Why did that happen?

_____

_____

_____

2.7   Connecting the Computer to a Secure Wireless Network

2.8.1 View wireless networks associated with the wireless adapter configured to the computer.

2.8.2   Choose **Cisco#**, where # is the number assigned by the instructor, make sure **Connect automatically** is selected, and then click the **Connect** button.

2.8.3 When the **Connect to a Network** window opens, type **ITEv6.0!** for the **Security key**, and then click **OK**.

2.9 Cleaning Up

2.9.2 Connect the computer to one of the **Ethernet** ports on the wireless router with an Ethernet patch cable.

2.9.3 Return configurations by restoring to factory default or using the following settings:

Router Address Information:
- o IP address 192.168.1.1
- o Subnet mask 255.255.255.0
- o Router name Linksys

DHCP Server Setting Information:
- o Start IP address 192.168.1.100
- o Maximum number of users 50
- o Static DNS 1 (optional): 0.0.0.0 or leave it blank

SSID Values:
- o Network Name (SSID): Linksys
- o SSID Broadcast: Disabled

Channel number:
- o Channel: Auto

Router Access:
- o Router Password: admin

Wireless Security:
- o Security Mode: Disable

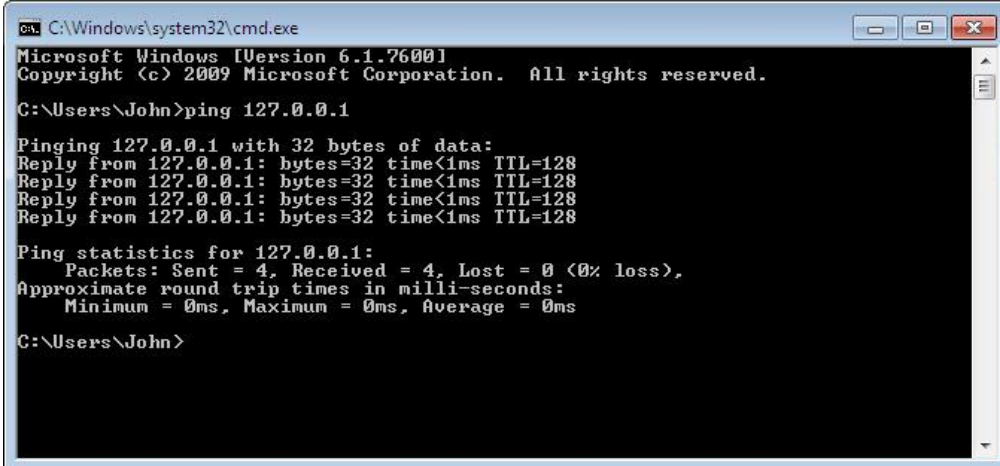2.9.4 Close the browser and logoff the computer.

2.10 Test the Wireless NIC in Windows

Step 13:   Ping the loopback.

a.   Disconnect the Ethernet cable from your computer.

 What are the names of the wireless connections that are available?

_____

b.   Connect to the classroom wireless network. Ask your instructor for the SSID
        and log on credentials if necessary.

c.   Open a command window.
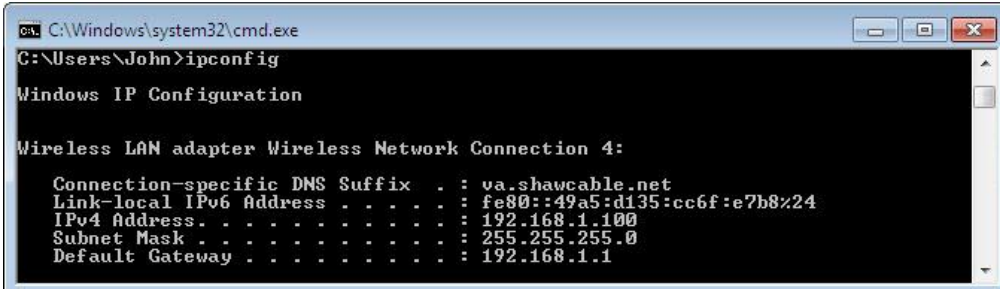
d.   Ping **127.0.0.1** to test the loopback.

How many Replies did you receive? _____

Why would you perform this test?

_____

Step 14:   Ping the default gateway.

a.   Use the **ipconfig** command.
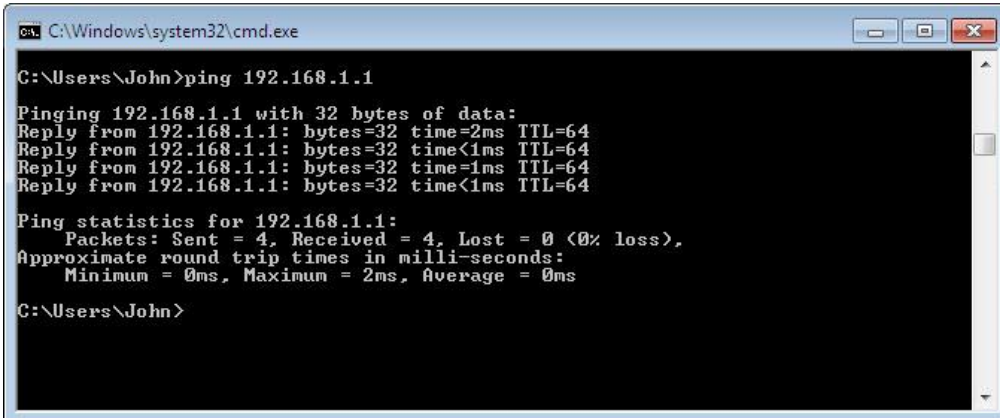
What is the IP address of the default gateway? _____

b. **Ping** the **default gateway**. A successful ping indicates that there is a connection between the computer and the default gateway.
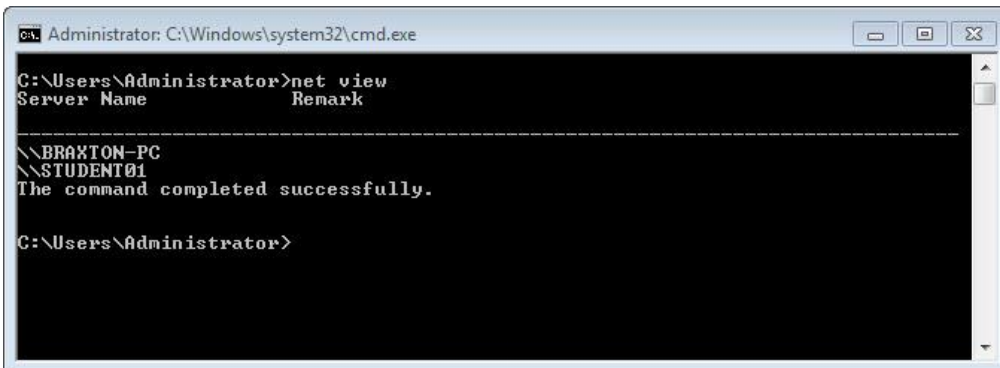
Step 15: Find computers on the network.

a. Type **net view** to make sure that you can see the other computers on the network. This indicates that there are no problems with the network between your computer and other computers on the same network.

List the computer names that are displayed.

_____

b. Use the **tracert** command along with your school's Web site or the Cisco Networking Academy Web site. Example: type **tracert www.netacad.com**.

What IP address was returned?

_____

How many devices (hops) are displayed?

_____

Why would you perform this test?

_____

c.   Use the **nslookup** command with the IP address you just discovered. Type
        nslookup 72.163.6.233.

What name was returned?

_____

Why would you perform this test?

_____

Step 16: **Test your Internet connection.**

a. Open a web browser.

b. Type **www.cisco.com** in the **Address** field, and then press **Enter**.
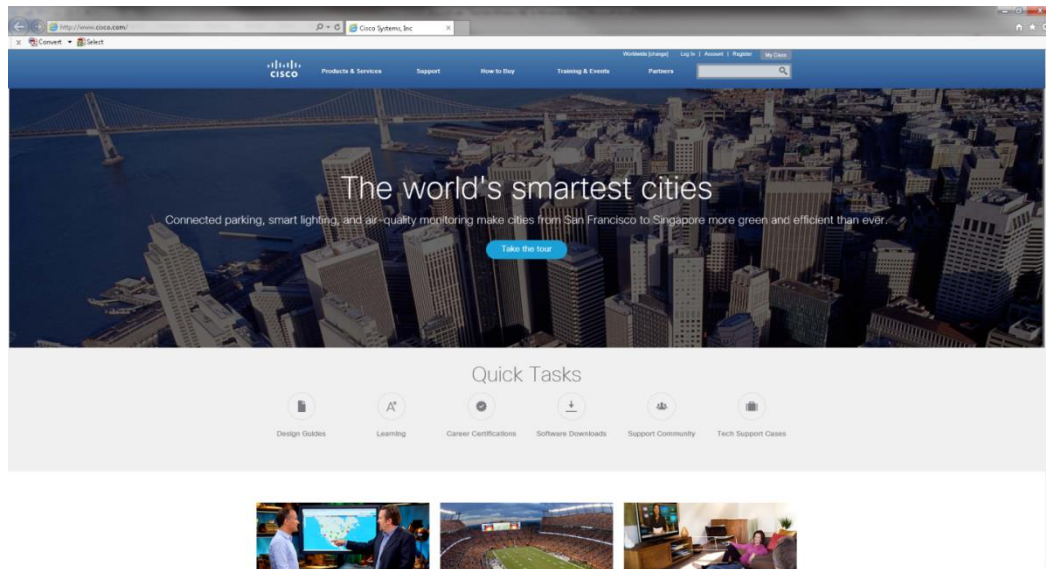
c. Click **Control Panel > Network and Sharing Center >. Change adapter settings**

Note: In Windows Vista, click **Control Panel > Network and Sharing Center >. Manage network connections**

d. Right-click the **Wireless Network Connection** icon **> Status**.
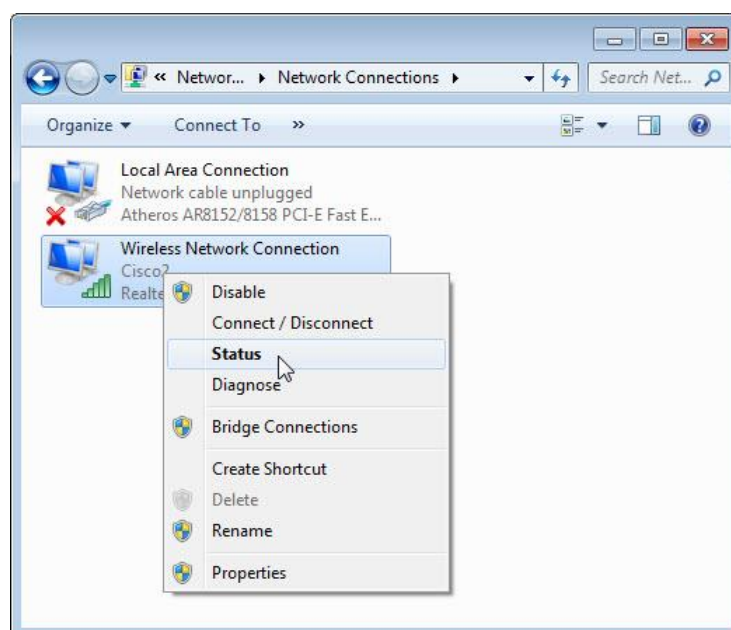
The **Wireless Network Connection Status** window opens.
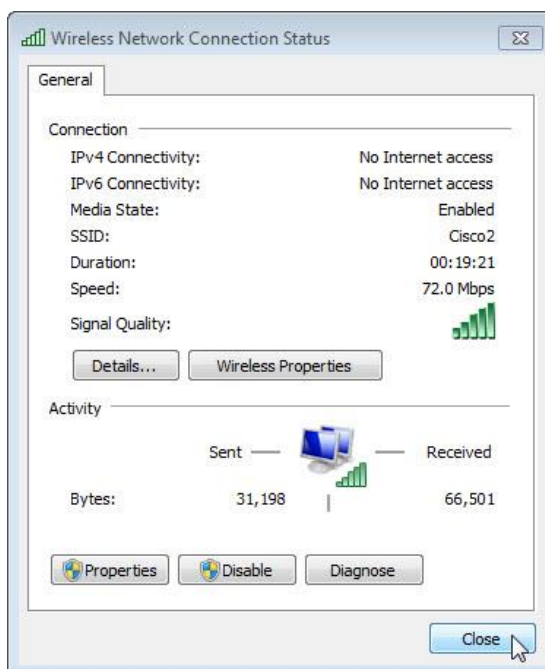
What is the state of the Media?

_____

What is the signal quality?

_____

e. Click **Close**.

Reflection

1. What information does a positive response from the default gateway provide for you when the computer has no Internet connection?

_____

_____

2. If you receive a positive response from the default gateway, but you have no Internet access, where is the problem?

_____

_____

3 Make a report on the laboratory work №7. The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page and submitted to the teacher in electronic and printed form.

4. Answer the following PC component questions.

4.1 What Is Bios?

4.2 Can You Please Explain The Difference Between Bios And Cmos?

4.3 How To Reset Cmos Or Bios Settings?

4.4 How Ami Bios Is Different?

4.5 List Other Bios?

4.6 Described Bios Flash Utility That Runs In Windows?

4.7 How To Create A Bootable Cd, With The Bios Flash Utility?

4.8 How Do Cmos And Acpi Relate To Bios?

4.9 How To Update Bios Chip?

4.10 What Is Post In Terms Of Bios?

Laboratory work №8
NUMBERING SYSTEMS

Purpose of work: learn to represent numbers in binary, octal, hexadecimal and binary-decimal number systems (MF); learn to translate numbers from one number system to another.

Objectives: students should be able to understand decimal, binary, octal and hexadecimal number systems/

1. Theoretical information of Number System.

1.1 Decimal numbers

The decimal number system uses the following 10 numbers or symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The radix is thus 10.

EXAMPLE 8.1. Decompose the numbers 734 and 12345 into powers of 10.

The decomposition of the number 734 takes the form:

$$734 = (7 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$$
$$= 734_{10}$$

For the number 12345, we have:

$$12\,345 = (1 \times 10^4) + (2 \times 10^3) + (3 \times 10^2) + (4 \times 10^1) + (5 \times 10^0)$$
$$= 12\,345_{10}$$

Depending on its position, each number is multiplied by the appropriate power of 10. The right-most digit represents the unit digit.

1.2 Binary Number System

The binary number system is a base 2 system with only two digits: **0** and **1**. A binary number such as "**11010**" is expressed with a string of **1s** and **0s**. The decimal equivalent of binary number can be found by expanding the number into a power series with **base of 2**. e.g.

EXAMPLE 8.2 $(11010)_2 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$=16+8+0+2+0$

$=(26)_{10}$

Another Example:

Binary: **1   1   1   0   0   1   0   1**

Power of two: 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

Decimal: 128 64 32 16 8   4   2   1

For the number 125, we have:

$$125_{10} = (1 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1)$$
$$+(1 \times 2^0) = 1111101_2$$

The total (in decimal) is *128 + 64 + 32 + 4 + 1 = 229*

Since we begin counting from zero, *n* bits can represent 2^n values: from 0 to 2^n-1 inclusive (e.g. 256 values, from 0 to 255, for 8bits).

Groups of bits form binary words.

1.2.1 Conversion from decimal to binary

The binary code that is then obtained for a positive number is called a natural binary code. The coefficients or numbers (0 or 1) used in the binary representation of a number are called bits.

The right-most bit is called the least significant bit (LSB), while the left-most bit is called the most significant bit (MSB).

In practice, the conversion of a decimal number to a binary number can be carried out by reading, from last to first, the remainders of a series of integer divisions as illustrated by Figure 8.1.

The arithmetic and logic unit of a microprocessor manipulates binary numbers or words with a fixed number of bits.

$$125 \div 2 = 62 \text{ Remainder } 1 \text{ (LSB)}$$
$$62 \div 2 = 31 \text{ Remainder } 0$$
$$31 \div 2 = 15 \text{ Remainder } 1$$
$$13 \div 2 = 6 \text{ Remainder } 1 \text{ (LSB)} \qquad 15 \div 2 = 7 \text{ Remainder } 1$$
$$6 \div 2 = 3 \text{ Remainder } 0 \qquad 7 \div 2 = 3 \text{ Remainder } 1$$
$$3 \div 2 = 1 \text{ Remainder } 1 \qquad 3 \div 2 = 1 \text{ Remainder } 1$$
$$1 \div 2 = 0 \text{ Remainder } 1 \text{ (MSB)} \qquad 1 \div 2 = 0 \text{ Remainder } 1 \text{ (MSB)}$$

$$13_{10} = 1101_2 \qquad\qquad 125_{10} = 1111101_2$$
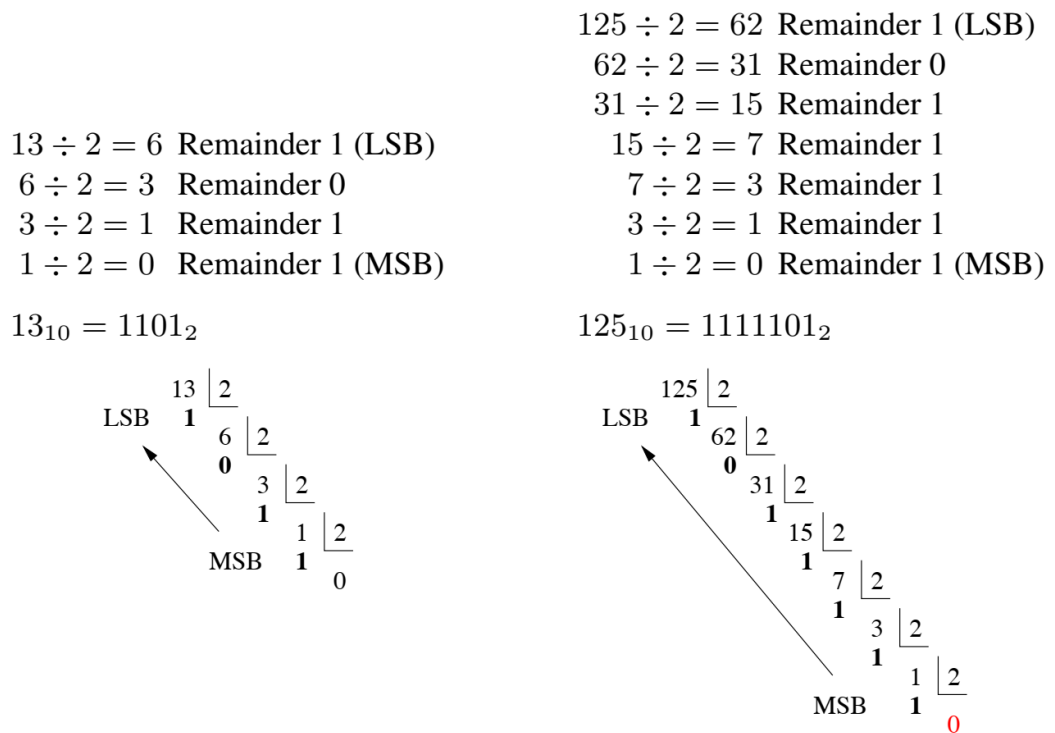
Figure 8.1. Decimal-binary conversion

Repeat division by 2

EXAMPLE 8.3 : Convert $(29)_{10}$ to binary

– 29/2 = 14 remainder 1 (LSB)

– 14/2 = 7 remainder 0

– 7/2 = 3 remainder 1

– 3/2 = 1 remainder 1

– 1/2 = 0 remainder 1

(MSB) $(29)_{10} => (11101)_2$

1.3 Octal Number System

To avoid writing down long binary words, it is often easier to use larger base systems. Two commonly-used systems are octal and hexadecimal.

The octal number system is base eight, i.e. values can be represented using an 8-symbol dictionary: 0-7.

To convert from binary to octal, binary numbers are grouped on 3-bitswords such that:

EXAMPLE 8.4. Convert the decimal numbers 250 and 777 to octal numbers.

In radix 8 representation, the number 250 takes the form:

$$250_{10} = (3 \times 8^2) + (7 \times 8^1) + (2 \times 8^0)$$
$$= 372_8$$

In the case of the number 777, we have:

$$777_{10} = (1 \times 8^3) + (4 \times 8^2) + (1 \times 8^1) + (1 \times 8^0)$$
$$= 1\ 411_8$$

The right-most digit is called the least significant digit (LSD), while the left-most digit is called the most significant digit (MSD).

A practical approach to converting a decimal number to an octal number consists of carrying out a series of integer divisions as illustrated in Figure 8.2.

$$250 \div 8 = 31 \text{ Remainder 2 (LSD)}$$
$$31 \div 8 = 3 \quad \text{Remainder 7}$$
$$3 \div 8 = 0 \quad \text{Remainder 3 (MSD)}$$

$$250_{10} = 372_8$$

$$777 \div 8 = 97 \text{ Remainder 1 (LSD)}$$
$$97 \div 8 = 12 \text{ Remainder 1}$$
$$12 \div 8 = 1 \text{ Remainder 4}$$
$$1 \div 8 = 0 \text{ Remainder 1 (MSD)}$$

$$777_{10} = 1411_8$$
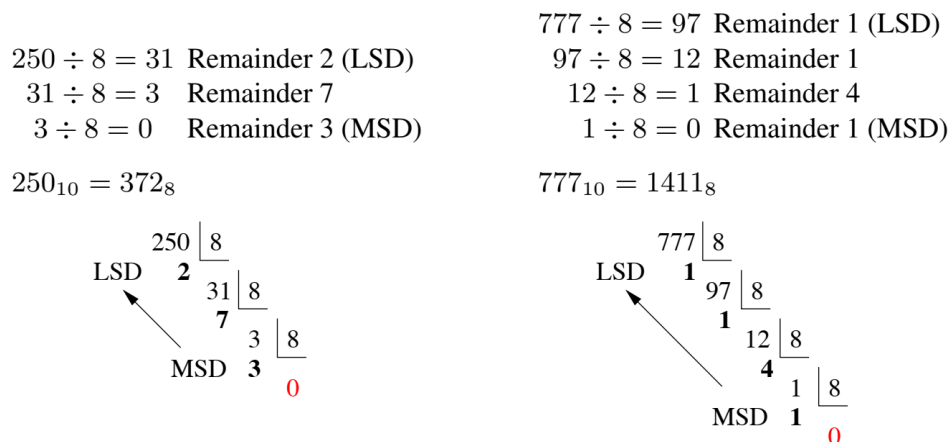
Figure 8.2. Decimal-octal conversion

Octal numeration may be deduced from binary numeration by grouping, beginning from the right, consecutive bits in triplets or, conversely, by replacing each octal number by its three corresponding bits (table 8.1).

EXAMPLE 8.5. Determine the radix 8 representation for the decimal numbers 85 and 129.

Radix 8 representations are obtained by replacing each group of three bits by the equivalent octal number. We can therefore write:

$$85_{10} = 1010101_2 = \underbrace{001}_{1}\ \underbrace{010}_{2}\ \underbrace{101}_{5} = 125_8$$

Similarly,

$$129_{10} = 10000001_2 = \underbrace{010}_{2}\ \underbrace{000}_{0}\ \underbrace{001}_{1} = 201_8$$

Table 8.1 - Representation of numbers in different number systems

Number System				
Decimal	Binary	Octal	Hexadecimal	Binary-decimal
1	**2**	**3**	**4**	**5**
0	0	0	0	0000
1	1	1	1	0001
2	10	2	2	0010
3	11	3	3	0011
4	100	4	4	0100
5	101	5	5	0101
6	110	6	6	0110
7	111	7	7	0111
8	1000	10	8	1000
9	1001	11	9	1001
10	1010	12	A	0001 0000
11	1011	13	B	0001 0001
12	1100	14	C	0001 0010
13	1101	15	D	0001 0011
14	1110	16	E	0001 0100
15	1111	17	F	0001 0101

1.4 Hexadecimal numeration

The hexadecimal number system or a representation with a radix 16 consists of the following symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.

EXAMPLE 8.6 . Convert the decimal numbers 291 and 1000 to hexadecimal.

The number 291 is represented in radix 16 by:

$$291_{10} = (1 \times 16^2) + (2 \times 16^1) + (3 \times 16^0)$$
$$= 123_{16}$$

For the number 1000, we obtain:

$$1\,000_{10} = (3 \times 16^2) + (14 \times 16^1) + (8 \times 16^0)$$
$$= 3E8_{16}$$

In practice, a series of integer divisions makes it possible to convert a decimal number to a hexadecimal number. The different remainders constitute the results of the conversion, beginning with the last, which is the MSD, to the first, which represents the LSD. We thus have:

$291 \div 16 = 18$ Remainder 3 (LSD) $1000 \div 16 = 62$ Remainder 8 (LSD)
$18 \div 16 = 1$ Remainder 2 $62 \div 16 = 3$ Remainder 14
$1 \div 16 = 0$ Remainder 1 (MSD) $3 \div 16 = 0$ Remainder 3 (MSD)

$291_{10} = 123_{16}$ $1000_{10} = 3E8_{16}$

$$
\begin{array}{cc}
 & 291\,|\,16 \\
\text{LSD}\quad \mathbf{3} & \\
 & 18\,|\,16 \\
\mathbf{2} & \\
 & 1\,|\,16 \\
\text{MSD}\quad \mathbf{1} & \\
 & 0
\end{array}
\qquad
\begin{array}{cc}
 & 1000\,|\,16 \\
\text{LSD}\quad \mathbf{8} & \\
 & 62\,|\,16 \\
\mathbf{14} & \\
 & 3\,|\,16 \\
\text{MSD}\quad \mathbf{3} & \\
 & 0
\end{array}
$$

Figure 8.3. Decimal-hexadecimal conversion

We can also proceed as demonstrated in Figure 8.3, the result of each conversion being made up of the successive remainders of the divisions.

Binary to hexadecimal conversion is done by grouping the bits representing the binary four by four and beginning from the right, conversely, replacing each hexadecimal digit by its four corresponding bits.

EXAMPLE 1.7 – Convert the decimal numbers 31 and 2, 988 into hexadecimal.

To obtain the equivalent hexadecimal from the binary representation, each group of four bits is replaced by the corresponding hexadecimal digit. We therefore have:

$$31_{10} = 11111_2 = \underbrace{0001}_{1}\ \underbrace{1111}_{15=F} = 1F_{16}$$

Similarly,

$$2\,988_{10} = 101110101100_2 = \underbrace{1011}_{11=B}\ \underbrace{1010}_{10=A}\ \underbrace{1100}_{12=C} = BAC_{16}$$

It is generally more convenient to represent the value of an octet using two hexadecimal digits as it is more compact.

2. Tasks for laboratory work

According to the serial number in the group log, select the numbers from table 2.1. Give the given numbers in binary, octal, hexadecimal and binary-decimal number systems. The results are presented in the form of table 8.2.

Table 8.2 - Options for individual tasks

Variant	Number systems			
	Decimal	Binary	Octal	Hexadecimal
1	234	1110111	234	A34
2	432	10010111	432	B32
3	567	11001011	567	C67
4	543	10110011	543	543
5	786	10101011	756	7FF
6	469	1111001	463	46A
7	897	10001110	736	A197
8	438	11011010	437	4A38
9	291	10010010	261	2B11
10	658	11101110	657	6E8
11	386	10000111	376	2B86
12	987	10111001	765	3E87
13	876	11100010	654	A76
14	564	01101100	564	B64
15	368	10010011	366	3A8
16	269	11001110	262	2C9
17	805	11100011	705	80D
18	675	11000110	675	2F5
19	931	10011001	731	9E1
20	873	11011011	773	87A
21	764	11001001	764	764
22	137	01100110	536	BC0
23	345	11011101	345	34D
24	456	10101111	456	4F6
25	678	11101110	671	678
26	765	10111011	765	1A65
27	891	11111101	561	A91
28	588	10000111	555	B88
29	677	10011111	677	A177
30	483	10011000	443	1B83

2.2   Check the results of representing numbers in binary, octal and hexadecimal number systems with the help of a demonstration program.

3. The course of obtaining results (for example, for option № 30 from table. 8.3)

Table 8.3 - Specified numbers for different numerical systems

№	Decimal	Binary	Octal	Hexadecimal	Binary-decimal
1	**483**				
2		**10011000**			
3			**443**		
4				***1B83***	

3.1 Convert the following numbers 483_{10} to binary

483_{10} $\square$ $?_2$

Solution.

Step 1. Perform the division operation:

Reply: $483_{10} \square$ 111100011_2 – this result should be entered in table. 3.2 (at the intersection of row 1 and column 2).

3.1.1 Audit

Weights units	$2^8=256$	$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
Number	1	1	1	1	0	0	0	1	1

$1 \cdot 256 + 1 \cdot 128 + 1 \cdot 64 + 1 \cdot 32 + 1 \cdot 2 + 1 = 483_{10}$

3.2 Convert the following numbers 483_{10} to Octal nuber systems.

483_{10} $\square$ $?_8$

Solution.

Method 1. Perform the division operation

$$
\begin{array}{r|l}
483 & 8 \\
\underline{48} & 60\,|\,\underline{8} \\
3 & 56\,\,7 \\
& 4
\end{array}
$$

$483_{10} \square 743_8$

Method 2. Divide the binary number obtained in § 3.1 into triads from right to left and represent each triad with the corresponding octal digit:

$483_{10} \rightarrow 111100011_2 \rightarrow 111.100.011$

$111_2 \square 7_8 \; 100_2 \square 4_8 \; 011_2 \square 3_8$

$111.100.011_2 \square 743_8$

3.2.1 Audit $743_8 \square 7 \cdot 8^2 + 4 \cdot 8^1 + 3 \cdot 8^0 = 7 \cdot 64 + 4 \cdot 8 + 3 = 483_{10}$

Reply: $483_{10} \square 743_8$ – this result should be entered in table. 3.2 (at the intersection of row 1 and column 3).

3.3 Convert the following numbers 483_{10} to hexadecimal.

$483_{10} \quad \square \quad ?_{16}$

Solution.

Method 1. Perform the division operation

$483|\underline{16}$

$\underline{48} \quad 30|\underline{\,16}$

$3 \quad \underline{16} \quad \underline{1}$

$ \quad 14$

$14_{10} \square E_{16} \; 483_{10} \square 1E3_{16}$

Method 2. Divide the binary number obtained in paragraph 4.1 into notebooks (fours) from right to left and each tetrad is represented by the corresponding

hexadecimal number from 0 to 9 or A, B, C, D, E, F :

$483_{10} \rightarrow \underline{111100011}_2 \rightarrow 0001.1110.0011$

$0001_2 \square 1_{16} \quad 1110_2 \square E_{16} \quad 0011_2 \square 3_{16}$

$0001.1110.0011 \square 1E3_{16}$

3.3.1 Audit $1E3_{16} \square 1 \cdot 16^2 + 14 \cdot 16^1 + 3 \cdot 16^0 = 256 + 224 + 3 = 483_{10}$

Reply: $483_{10} \square 1E3_{16}$ – this result should be entered in table. 3.2 (at the intersection of row 1 and column 4).

3.4 Convert the number 483_{10} from decimal to binary-decimal number system

$48310 \square ?2\text{-}10$

Solution. Each decimal digit is represented by the corresponding binary notebook (see table 1).

$4_{10} \square 0100_2 \qquad 8_{10} \square 1000_2 \qquad 3_{10} \square 0011_2$

Reply: $483_{10} \square 010010000011_{2\text{-}10}$ – this result should be entered in table. 8.4 (at the intersection of row 1 and column 5).

Lines 2, 3 and 4 in table. 3.2 must be filled in similarly.

Table 8.4 – The result of representing numbers in different number systems (example for option № 30 from table 2)

№ ряд ка	Decimal	Binary	Octal	Hexadeci mal	Binary-decimal
	1	2	3	4	5
1	**483**	111100011	743	1E3	0100 1000 0011
2	152	**10011000**	230	98	0001 0101 0010
3	291	100100011	**443**	123	0010 1001 0001
4	7043	1101110000011	15603	**1B83**	0111 0000 0100 0011

4. Contents of the report

The report should be printed on A4 sheets (in the footers indicate: last name, first name, patronymic, and student group number). At the end of the laboratory work, all reports are stapled into one document with the title page (Appendix A) and submitted to the teacher in electronic and printed form.

RECOMMENDED LITERATURE

1. Standart vyshchoi osvity Ukrainy: pershyi (bakalavrskyi) riven, haluz znan 14 - Elektrychna inzheneriia, spetsialnist 141 - Elektroenerhetyka, elektrotekhnika ta elektromekhanika. – 22 s.

2. Kashtan V.Yu. Methodological instructions for the implementation of laboratory works in the discipline "Computer Engineering and Programming" for students of specialty 141 "Power engineering, electrical engineering and electromechanics" [Electronic resource], Part1. – 2021.

3. Kashtan V.Yu. Computer Engineering and Programming for students of specialty 141 "Power engineering, electrical engineering and electromechanics", 2021 Moodle. URL: https://do.nmu.org.ua/course/view.php?id=3446

4. Osnovy informatyky ta obchysliuvalnoi tekhniky: pidruchnyk / V. H. Ivanov, V. V. Karasiuk, M. V. Hvozdenko; za zah. red. V. H. Ivanova. — Kh.: Pravo, 2015. — 312 s.

5. Sarah L. Harris, David Harris. Digital Design and Computer Architecture: ARM Edition 1st Edition. – Morgan Kaufmann. – 2015. – 584p.

6. Ivanov V. H. Osnovy informatyky ta obchysliuvalnoi tekhniky: pidruch. / V. H. Ivanov, V. V. Karasiuk, M. V. Hvozdenko; zazah. red. V. H. Ivanova. – Kh.: Pravo, 2012.

7. Sommerville I. Software Engineering, 10th ed. — Addison-Wesley / Pearson Education Limited, 2015. — 816 p.

8. Lavrov Ye.A. Prohramuvannia na VISUAL BASIC 6.0. Praktykum [Tekst] : navchalnyi posibnyk / Ye. A. Lavrov, V. H. Lohvinenko ; Sumskyi natsionalnyi ahrarnyi universytet. - Sumy : SNAU, 2011. - 292 s.

9. Elektronika ta mikroskhemotekhnika: pidruchnyk / O.M. Vorobiova, I.P. Panfilov, M.P. Savytska, Yu.V. Fleita. – Odesa: ONAZ im. O.S. Popova, 2015. – 298 s.

10. Albert Paul Malvino. Digital computer electronics. – New Delhi : Tata Mcgraw Hill Education Pvt. Ltd. – 2011. – 522 p.

11. James Lance. The Beginner's Guide to Engineering: Computer Engineering. - CreateSpace Independent Publishing Platform. – 2013. – 158p. ISBN-10 : 1492981540

12. Cisco Academy IT Essentials Interactive Tutorial: https://netacad.com

Appendix A
Example of design of the title page for the report

Ministry of Education and Science of Ukraine
Dnipro University of Technology

Department of Information technology and computer Engineering

Report

Laboratory work №1:" Numbering Systems"

Completed:

Student groups:<u>141-20-7</u>
(group index)

_____
(surname and initials)

Checked:

<u>Assoc.Prof. Kashtan V.Yu.</u>
(position, surname and initials)

Dnipro
2021