Lecture 6

Analysis and Data Management

Learning Objectives

1 Why are information systems such an important aspect of everyday life?
2 How do information systems help organizations carry out their missions?
3 How do organizations use computers for strategic, tactical, and operational planning?
4 Can information systems solve structured, semistructured, and unstructured problems?
5 How can information systems help organizations respond to competition?
6 What kinds of information systems do organizations typically use?
7 What is an SDLC?
8 How do systems analysts use the PIECES framework?
9 What kinds of tools do systems analysts use for scheduling information systems projects and documenting system requirements?
10 Are most large corporate information systems handled by a centralized mainframe computer?
11 Are most information systems custom built?
12 How dependable are corporate information systems?
13 How does a new information system go live without disrupting business operations?
14 Can you measure how well an information system is performing?
15 How vulnerable are information systems to threats that could cause them to fail?
16 Do corporations and government agencies do a good job of protecting data that pertains to individuals?

Try It

P	Performance	List any tasks your computer performs slowly or software that doesn't respond as quickly as you would like.	
I	Information	List any examples of applications that don't provide you with the right information at the right time or in the most useable format.	
E	Economics	List any computing tasks that seem to cost too much.	
C	Control	List any computing tasks that make it difficult to control unauthorized access to your data.	
E	Efficiency	List any tasks that seem to take longer than necessary.	
S	Service	List any computing tasks that seem too complex or inconvenient.	

- An **information system** collects, stores, and processes data to provide useful, accurate, and timely information, typically within the context of an organization. Information systems encompass data; the people and machines that collect, process, output, and store data; the networks that transmit and receive data; and the procedures that govern the way data is handled.

Who uses information systems?

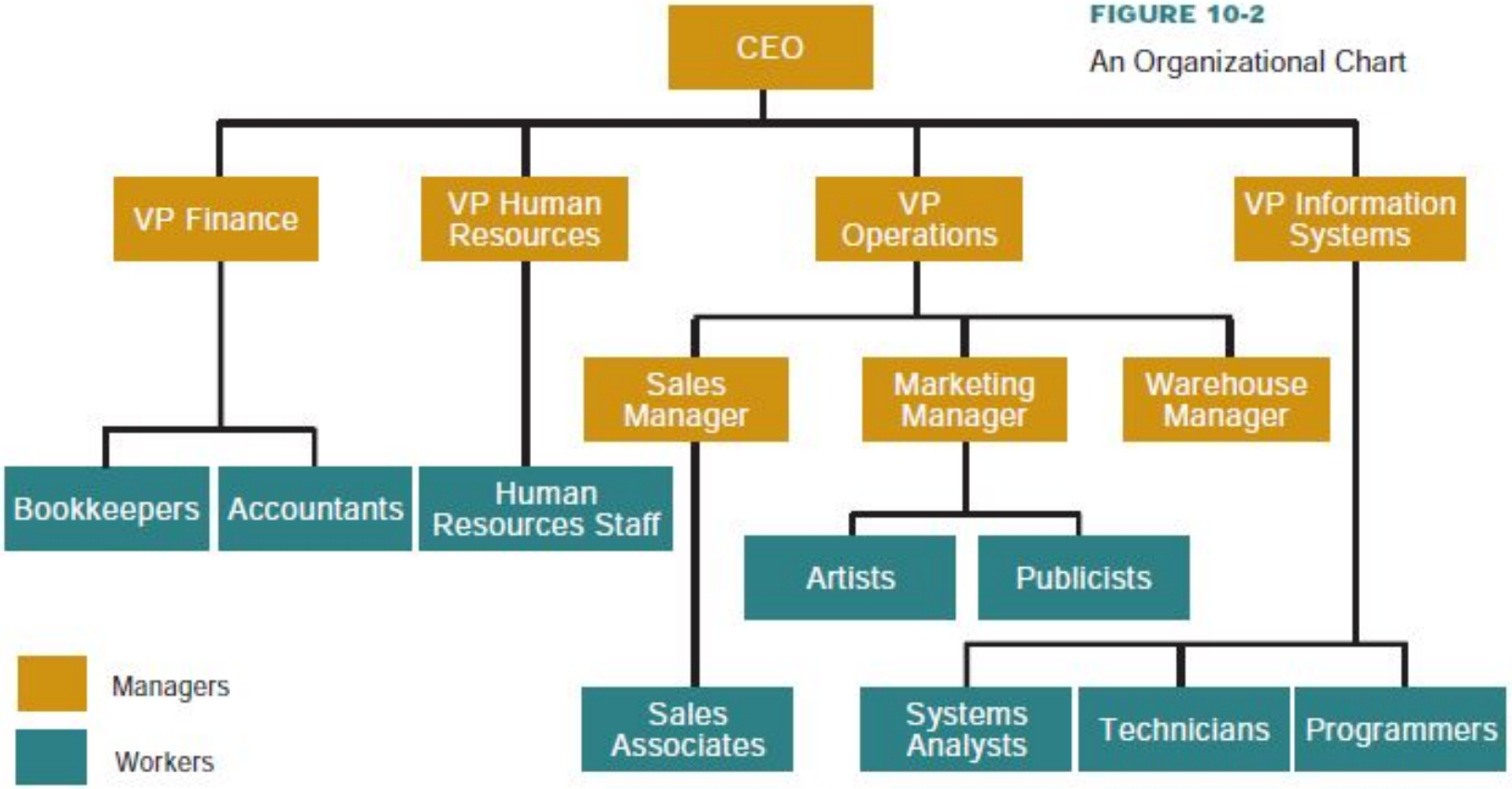


FIGURE 10-2

An Organizational Chart

How do information systems help the people in an organization?

Phase 1: Recognize a problem or a need to make a decision.

Phase 2: Devise and analyze possible solutions to the problem.

Phase 3: Select an action or a solution.

Classification of problem

- Structured - figuring out which customers should receive overdue notices
- Unstructured -deciding how much inventory

to stock for the holidays

- Semi-structured – decision based on her intuition of customer taste and fashion trends

TRANSACTION PROCESSING SYSTEMS

- a **transaction** is an exchange between two parties that is recorded and stored in a computer system.
- **transaction processing system** (TPS) provides a way to collect, process, store, display, modify, or cancel transactions


Payroll


Accounting

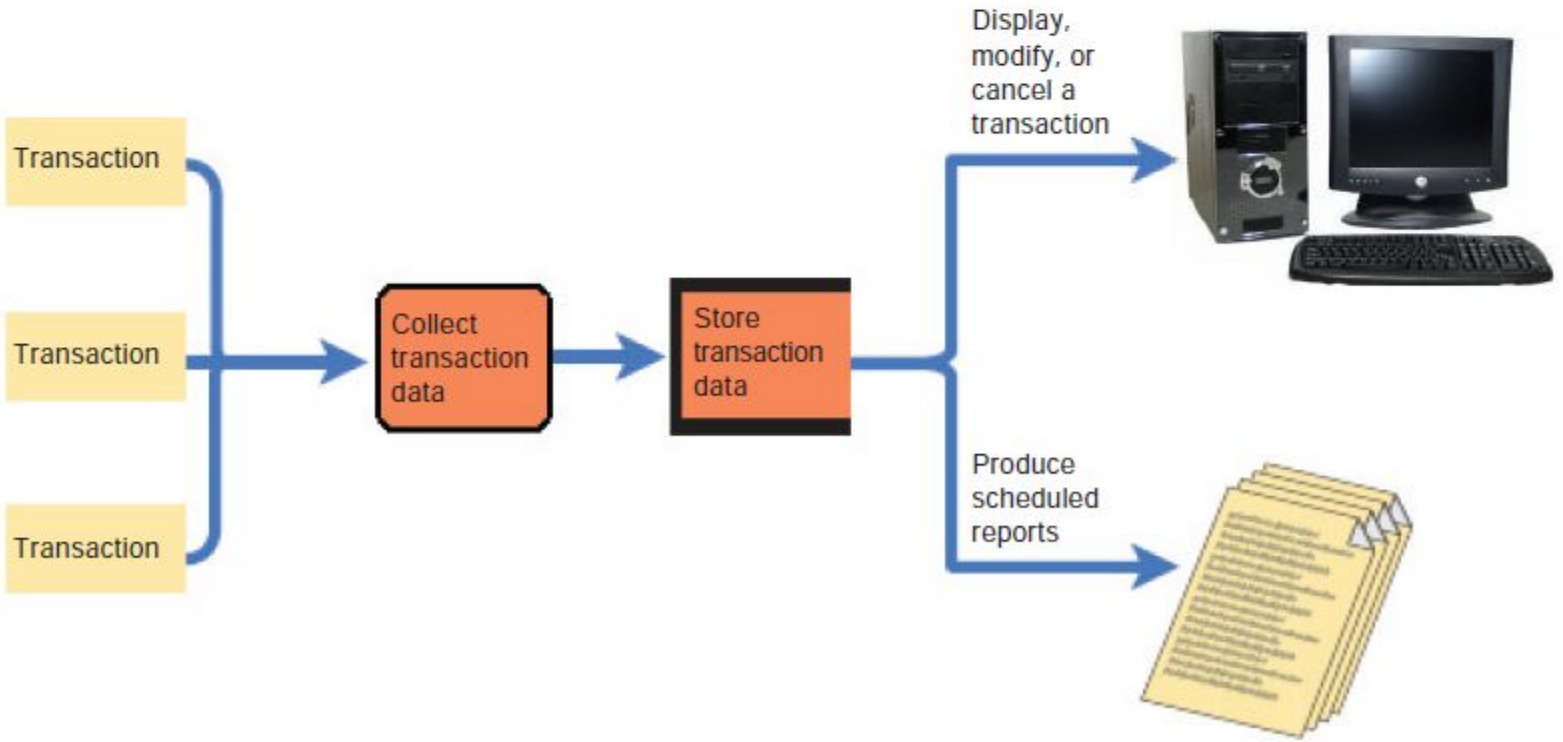

Inventory


Point of sale

transaction processing systems

- **batch processing**
- **online processing** referred to as an **OLTP system** (online transaction processing system).
- OLTP uses a **commit or rollback strategy**

How does commit or rollback work?



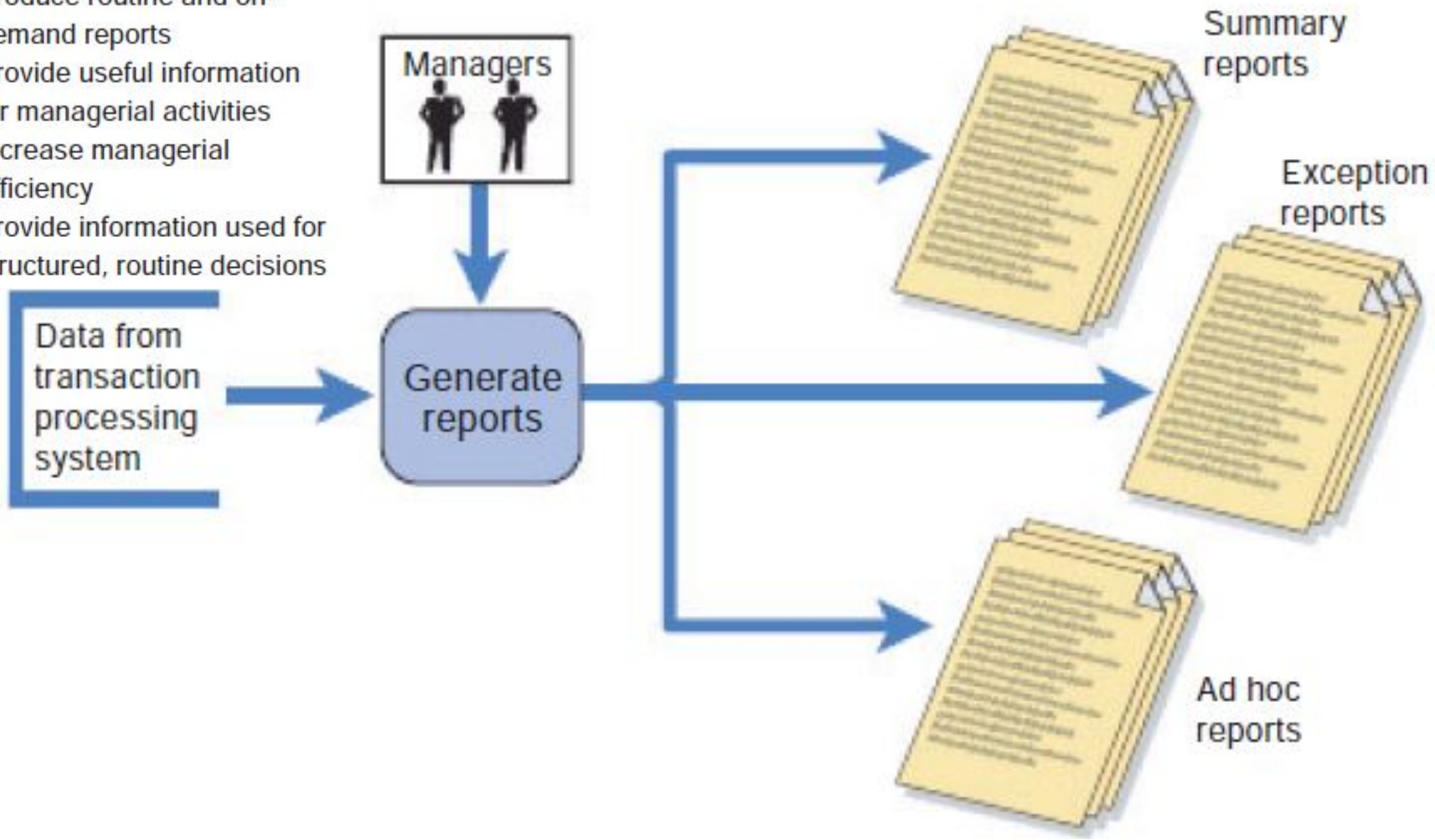
A transaction processing system is characterized by its ability to:

- Collect, display, and modify transactions
- Store transactions
- List transactions

MANAGEMENT INFORMATION SYSTEMS

A management information system is characterized by its ability to:

- Produce routine and on-demand reports
- Provide useful information for managerial activities
- Increase managerial efficiency
- Provide information used for structured, routine decisions



How does an MIS differ from a TPS?

TPS

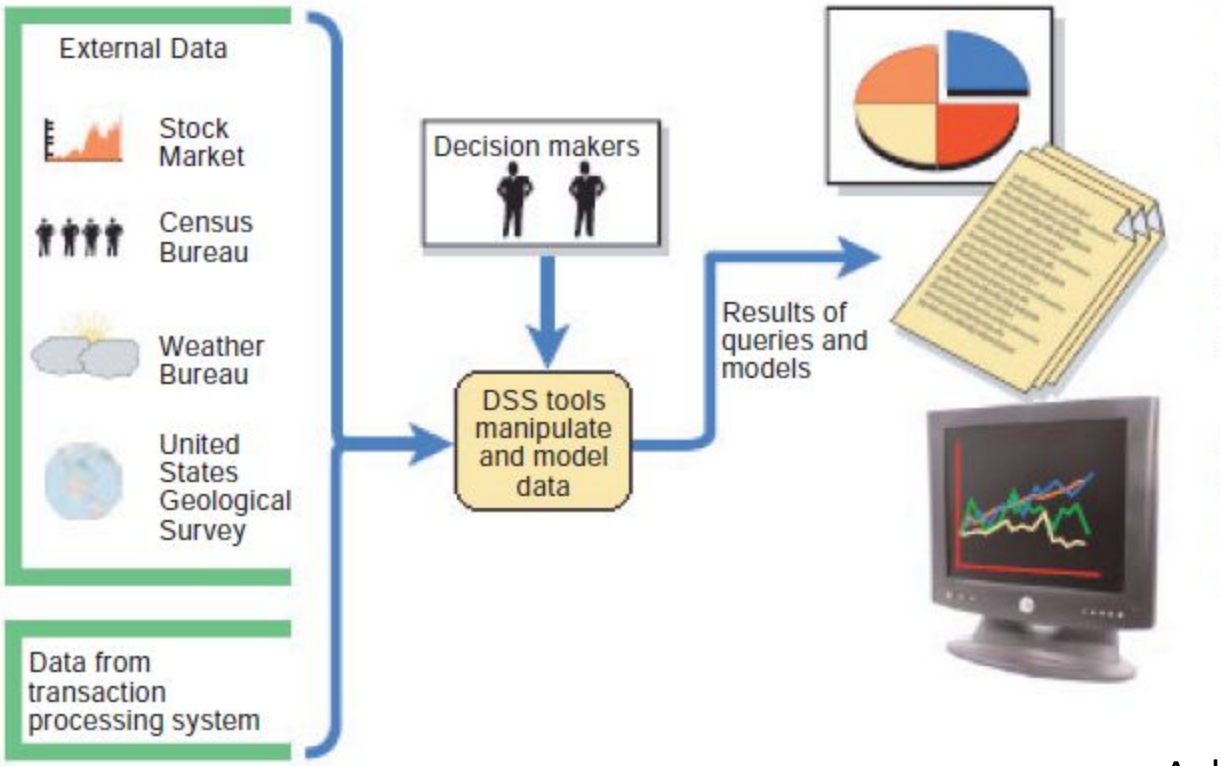
Purpose: Track books by maintaining a database of titles, checkout dates, and so forth
Users: Library patrons locating books and librarians checking books in and out
Key characteristic: Managing transactions as books are checked in and out

MIS

Purpose: Provide librarians with summary and exception reports needed to manage the collection
Users: Librarians requesting and analyzing reports
Key characteristics: Summary reports indicate how many books are checked out each day, each week, each month, or each year; exception reports list long-overdue books

DECISION SUPPORT SYSTEMS

- A **decision support system** (DSS) helps people make decisions by directly manipulating data, analyzing data from external sources, generating statistical projections, and creating data models of various scenarios.
- A special type of decision support system, called an **executive information system** (EIS), is designed to provide senior managers with information relevant to strategic management activities—such as setting policies, planning, and preparing budgets—based on information from internal and external databases.



A decision support system is characterized by its ability to:
Support, rather than replace, managerial judgment
Create decision models
Improve quality of decisions
Help solve semi-structured problems
Incorporate external data

EXPERT SYSTEMS AND NEURAL NETWORKS

- An **expert system**, sometimes referred to as a *knowledge-based system*, is a computer system designed to analyze data and produce a recommendation, diagnosis, or decision based on a set of facts and rules

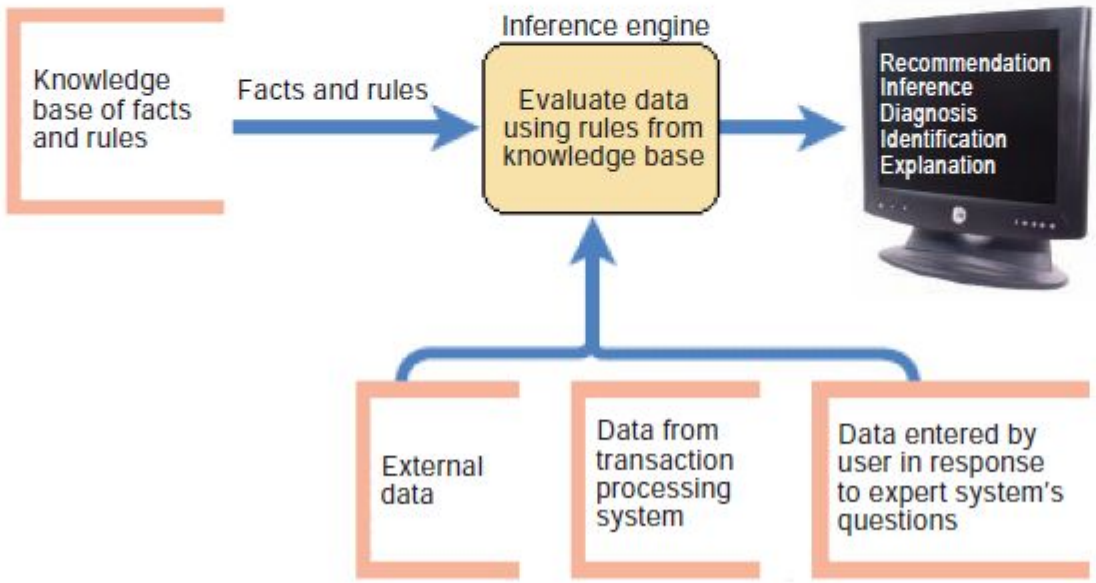


FIGURE 10-11

An expert system is characterized by its ability to:

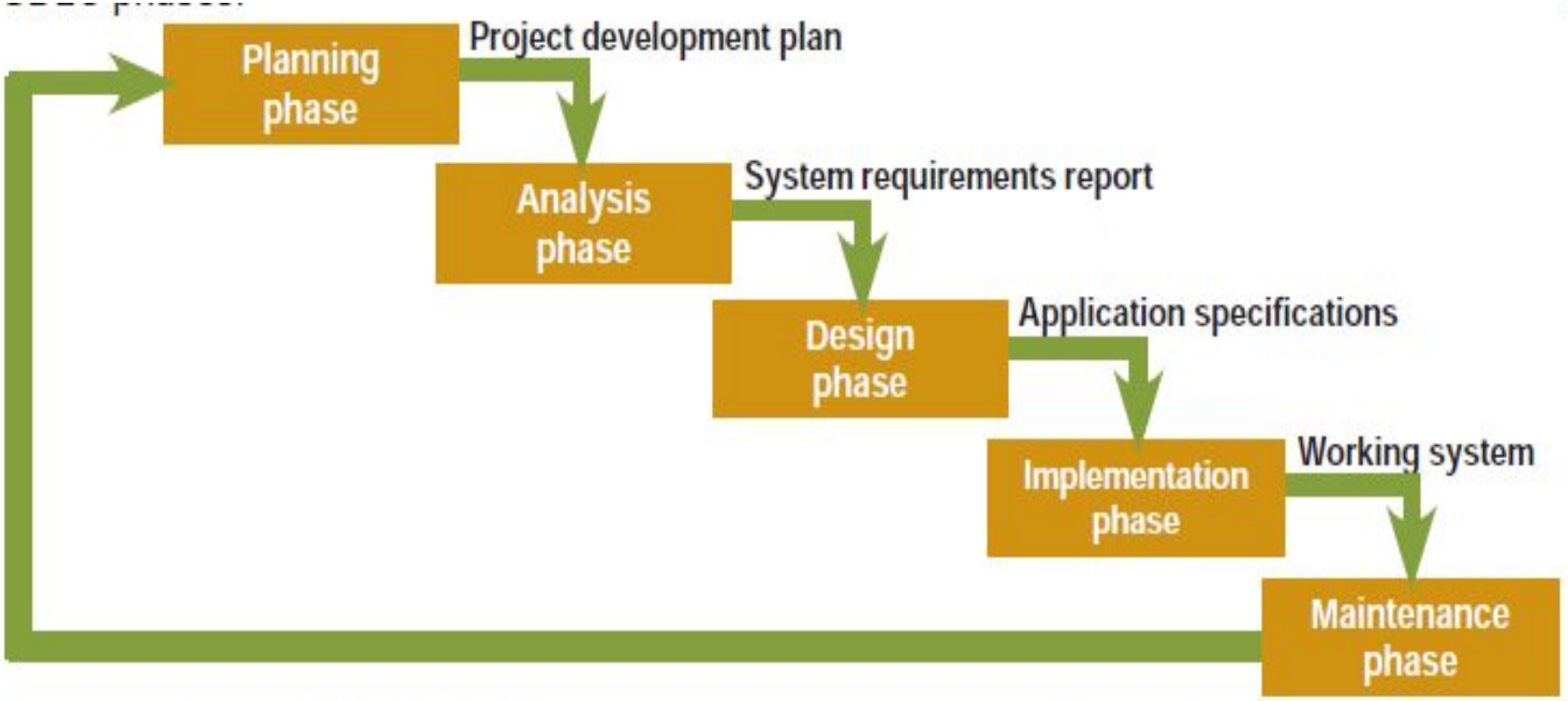
- Replicate the reasoning of a human expert
- Work with internal or external data
- Produce a recommendation or decision

- A **neural network** uses computer circuitry to simulate the way a brain might process information, learn, and remember.

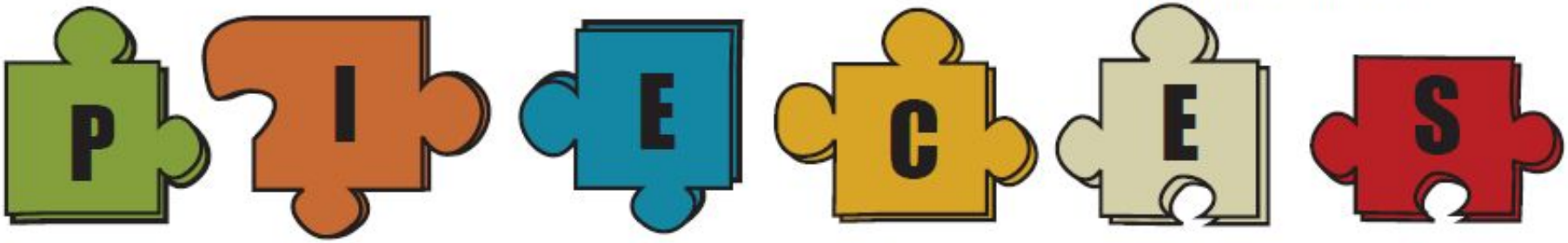
Neural networks have been developed for a variety of applications, including surveillance.

SECTION B

Systems Analysis



- system development life cycle



Performance
A performance problem means that an infor-mation system does not respond quickly enough to users or takes too long to complete process-ing tasks.

Information
An information problem means that users don't receive the right information at the right time in a usable format.

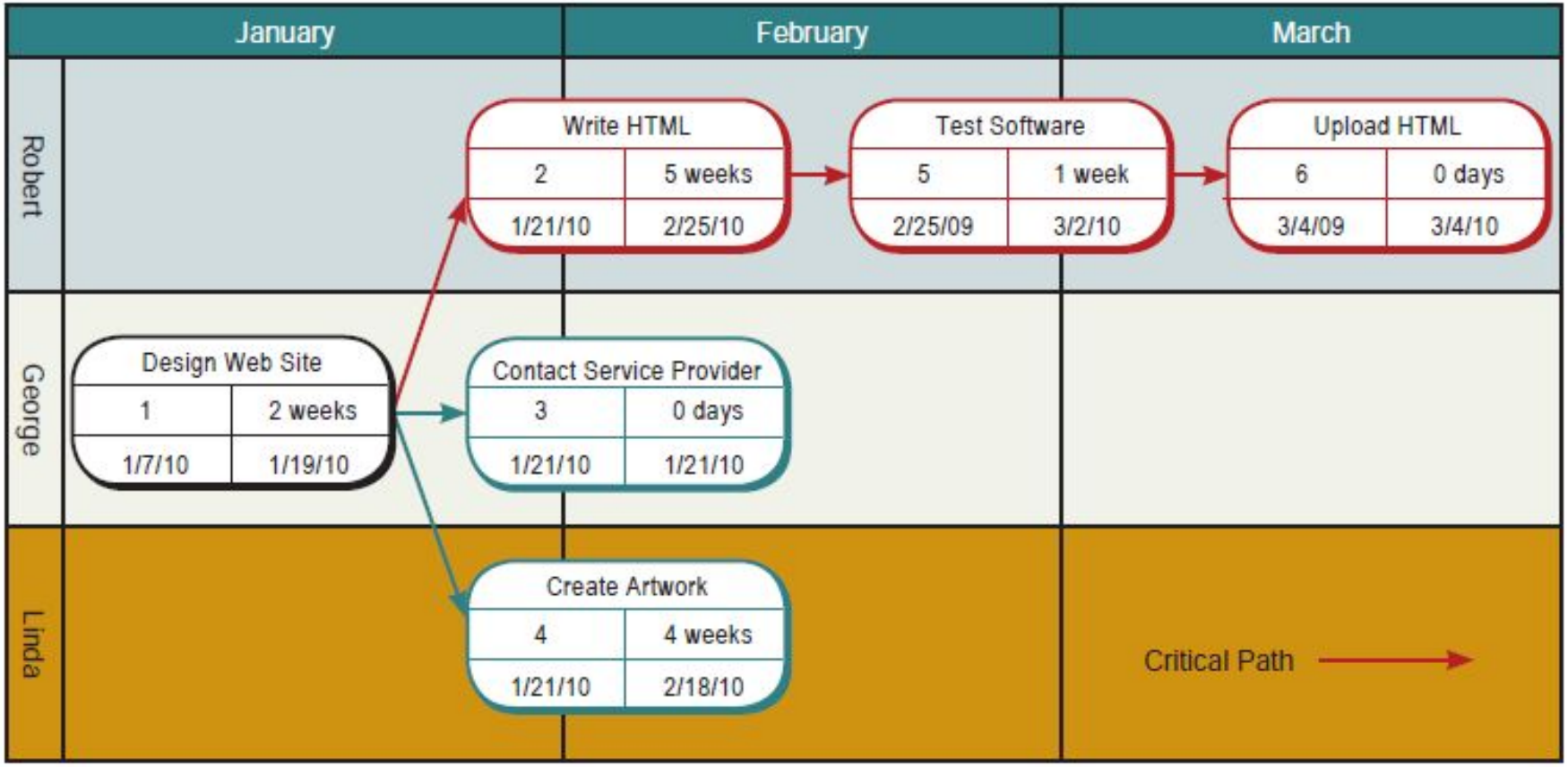
Economics
An economics problem means that the system costs too much to operate or use.

Control
A control problem means that informa-tion is available to unauthorized users or that authorized users are not given the authority to make decisions based on the information they receive.

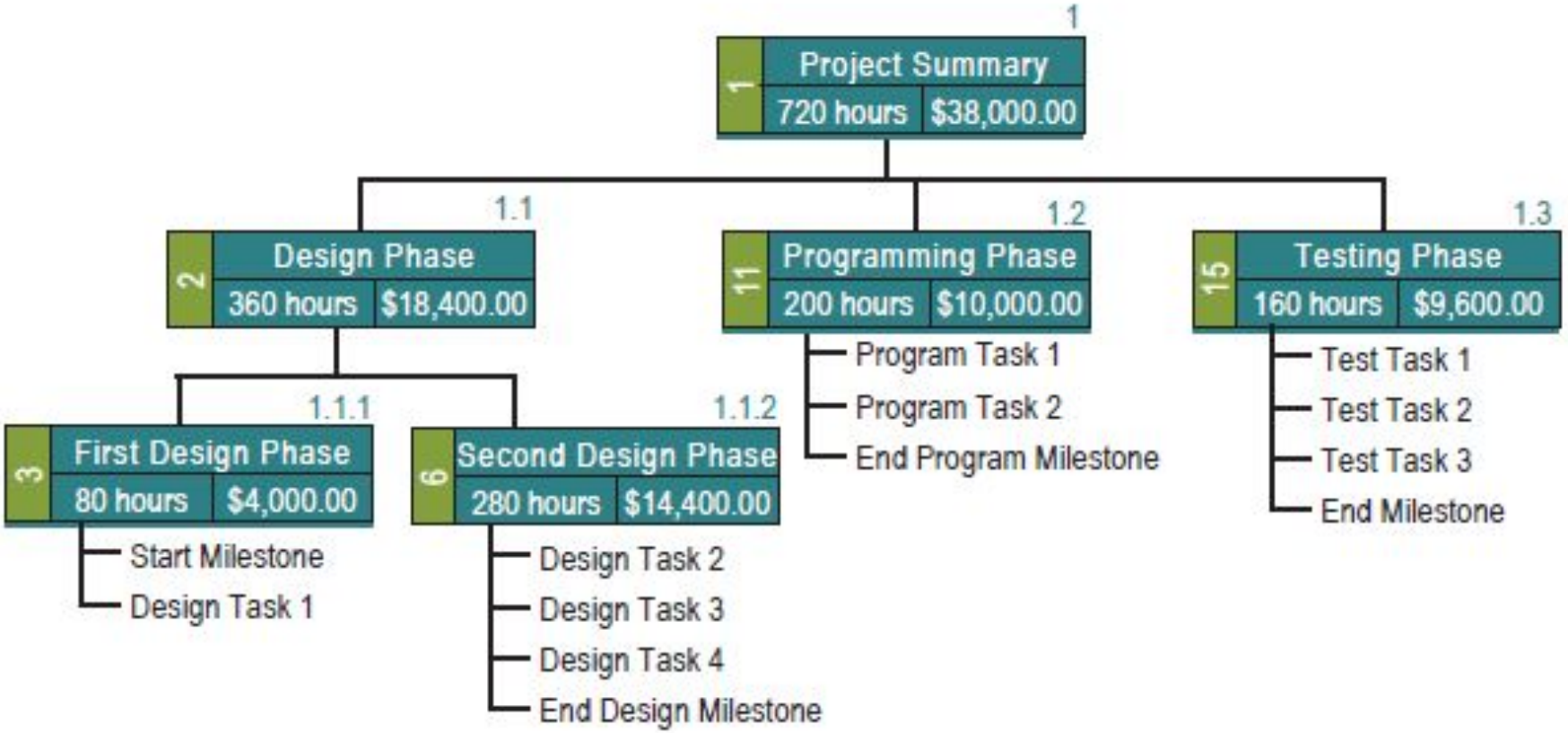
Efficiency
An efficiency problem means that too many resources are used to collect, process, store, and distribute information.

Service
A service prob-lem means that the system is too difficult or inconvenient to use.

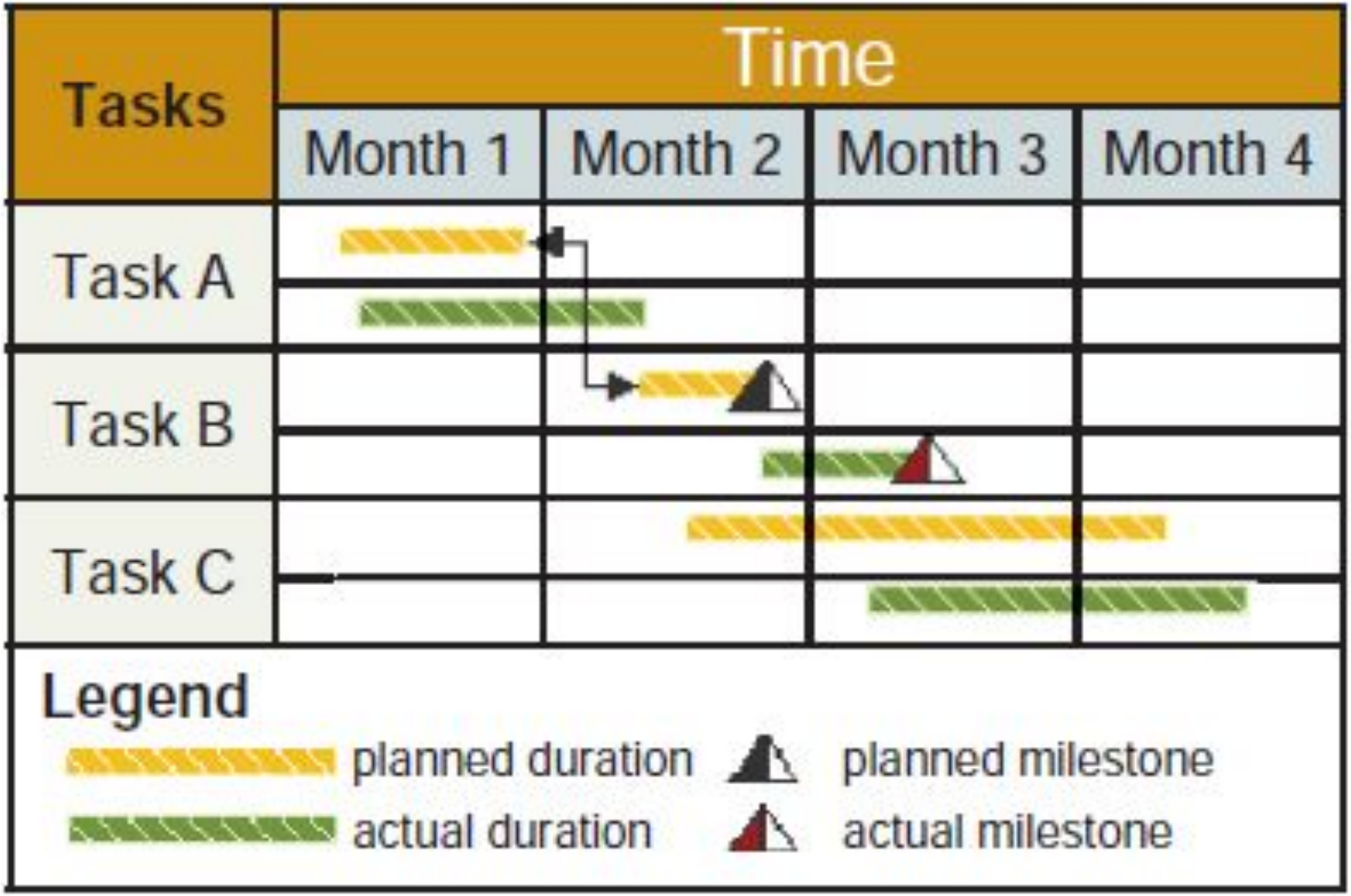
PERT (Program Evaluation and Review Technique) chart elements are arranged to show which tasks must be completed before subsequent dependent tasks can begin. By tracing paths through the diagram, project managers can determine the best-case and worst-case scheduling scenarios. The longest path through the tasks, shown in red, is called the critical path.



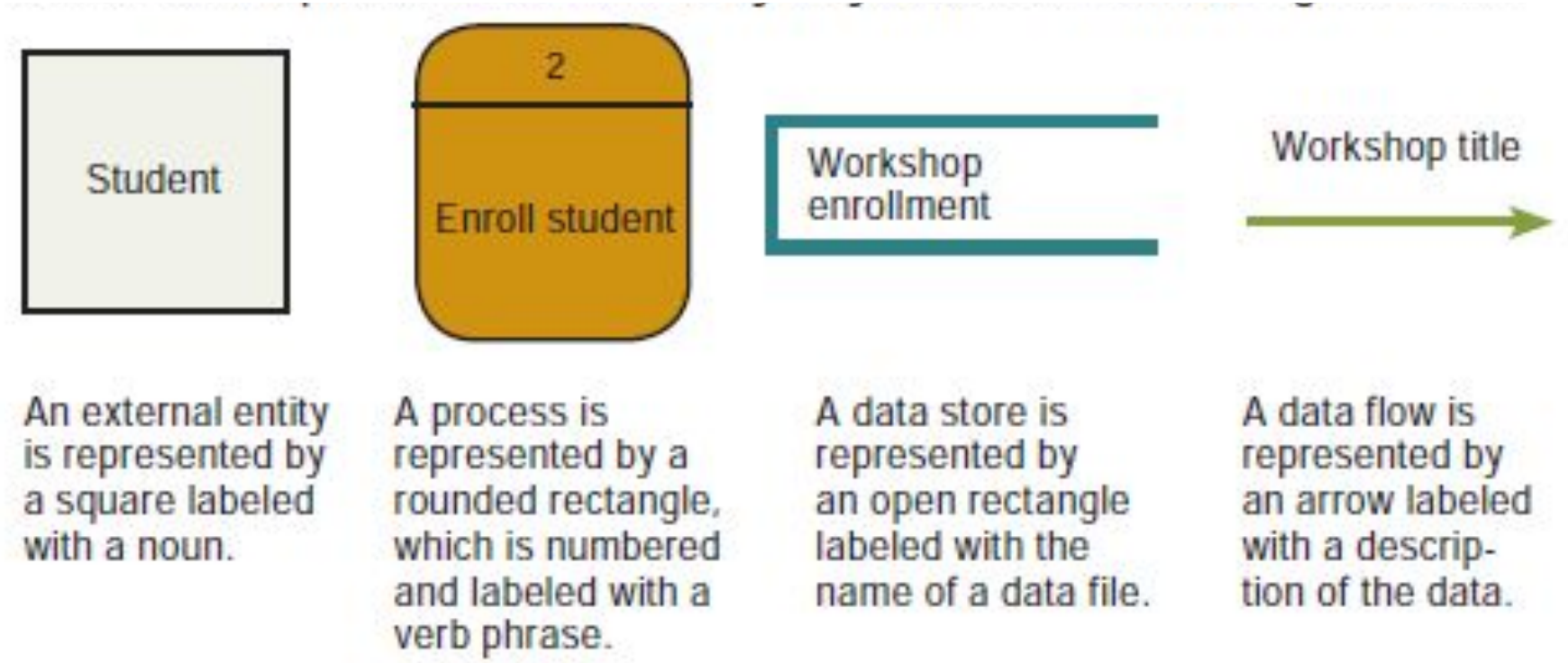
A **WBS** (work breakdown structure) breaks a complex task into a series of subtasks.



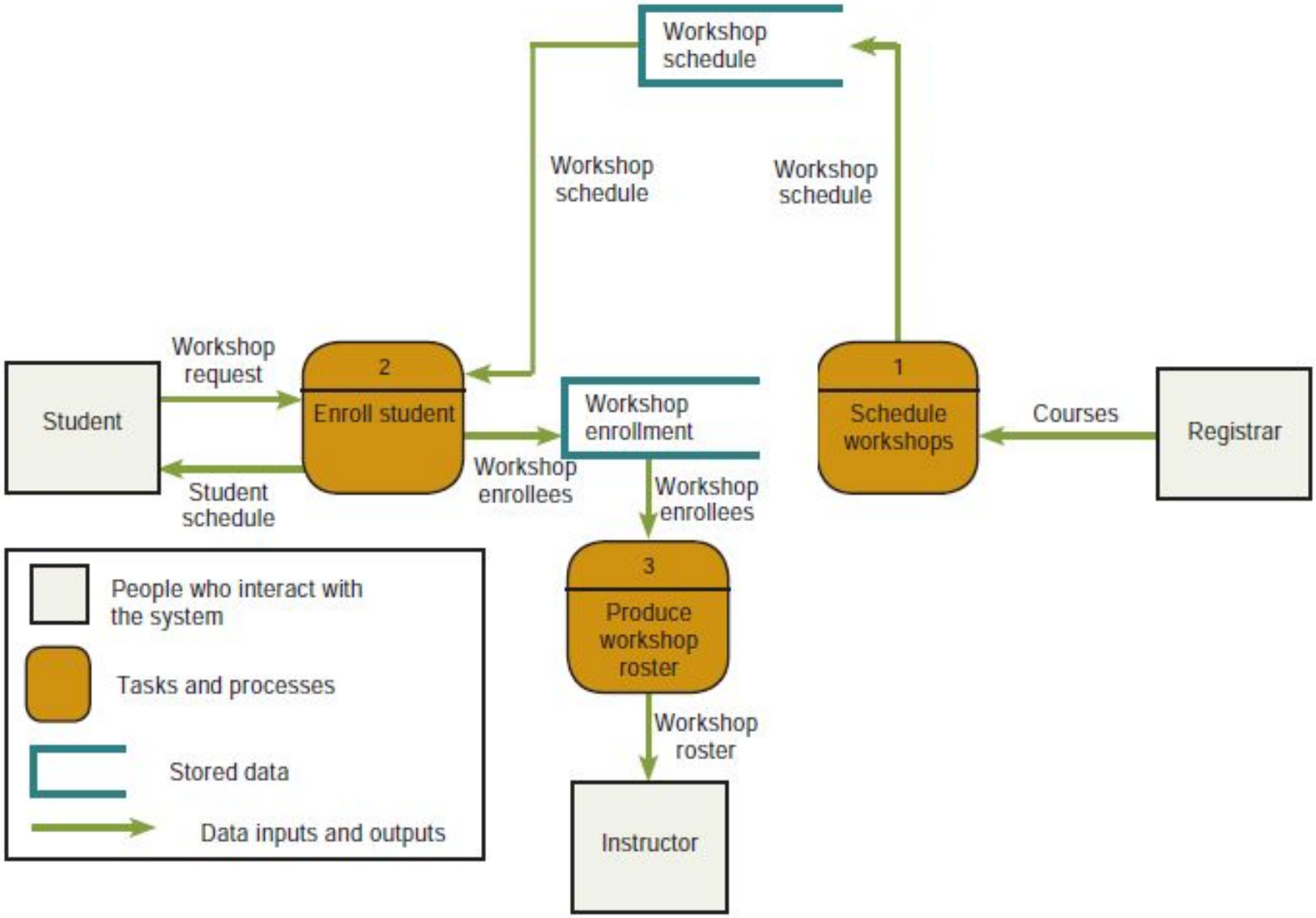
Gantt charts indicate the duration of each task. They can also show milestones and compare planned completion dates with actual completion dates.



What are structured documentation tools?



- Data Flow Diagram Symbols


Workshop schedule
Workshop schedule
Workshop schedule
Workshop request
Student
2
Enroll student
Student schedule
Workshop enrollment
Workshop enrollees
Workshop enrollees
1
Schedule workshops
Courses
Registrar
3
Produce workshop roster
Workshop roster
Instructor
People who interact with the system
Tasks and processes
Stored data
Data inputs and outputs

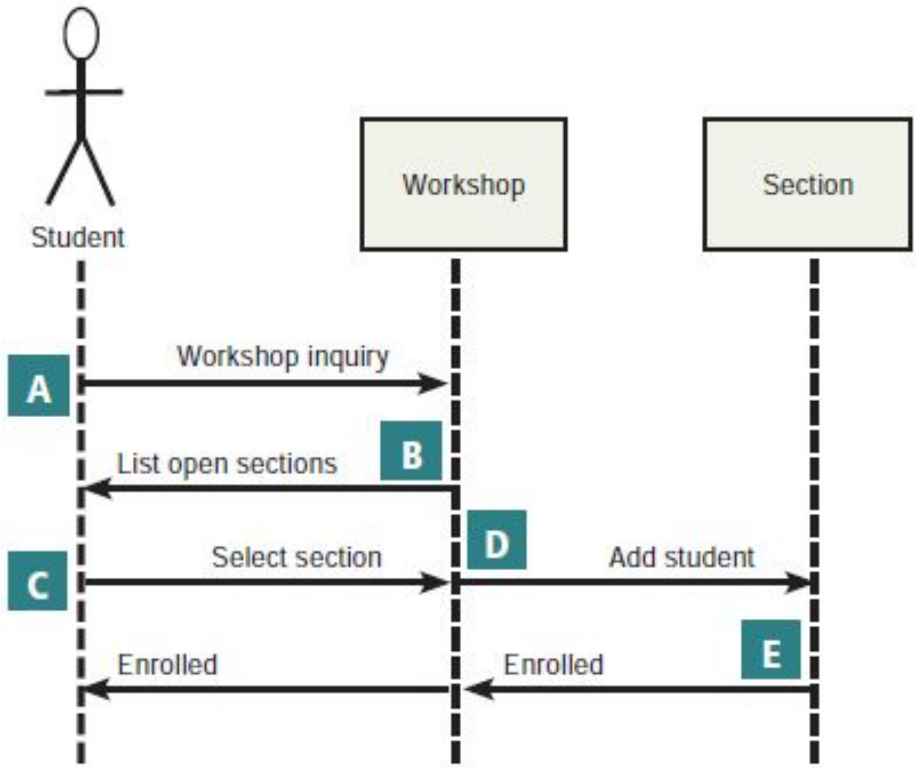


FIGURE 10-27

Sequence Diagram for the Enroll in a Workshop Use Case

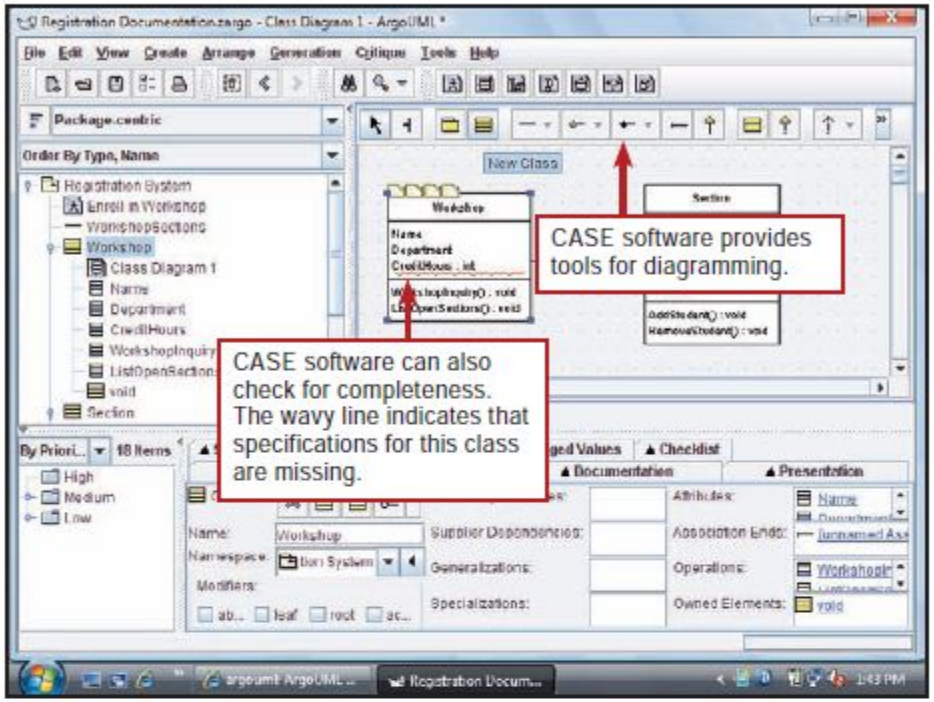
A A student enters the title or number of a workshop that he or she wants to take.

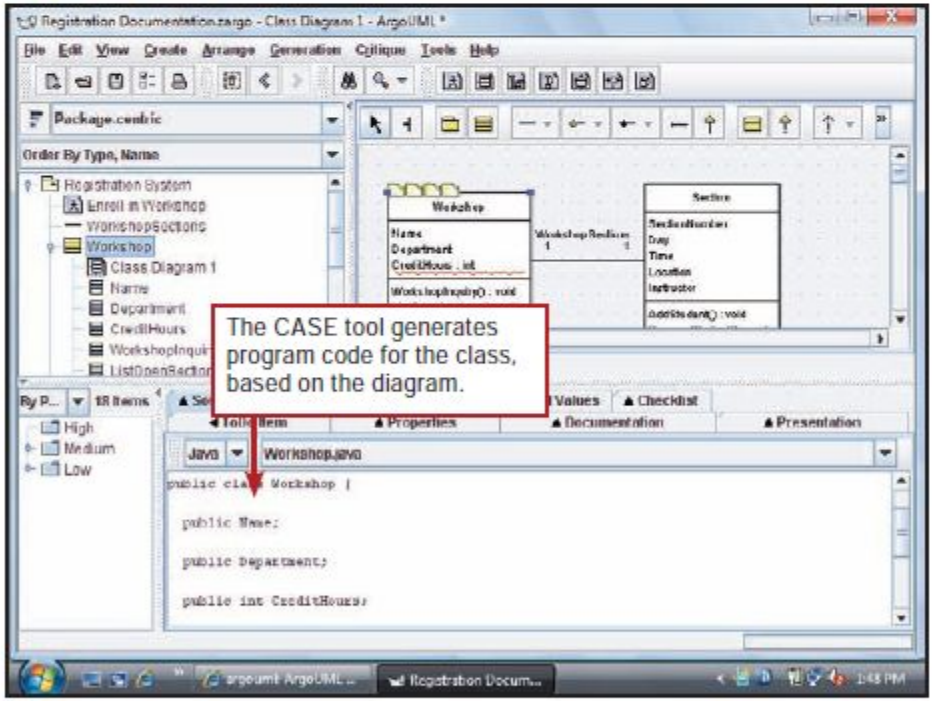
B The Workshop object displays a list of sections that are open.

C The student selects a section.

D The student is added to the workshop roster for the section.

E The student receives confirmation of the enrollment.


CASE software provides tools for diagramming.
CASE software can also check for completeness. The wavy line indicates that specifications for this class are missing.


The CASE tool generates program code for the class, based on the diagram.

x_1, x_2, x_3, x_4 signal

1 level

$$a_{1,0} = (x_1 + x_2)/2 \qquad d_{1,0} = (x_1 - x_2)/2$$
$$a_{1,1} = (x_3 + x_4)/2 \qquad d_{1,1} = (x_3 - x_4)/2$$

2 level

$$a_{0,0} = (a_{1,0} + a_{1,1})/2$$
$$d_{0,0} = (a_{1,0} - a_{1,1})/2$$

Result

- x_1, x_2, x_3, x_4  $\{a_{0,0}, d_{0,0}, d_{1,0}, d_{1,1}\}$

$$f(t) = x_1 X_{[0,1/4)}(t) + x_2 X_{[1/4,1/2)}(t) + x_3 X_{[1/2,3/4)}(t) + x_4 X_{[3/4,1)}(t)$$

$$X_{[a,b)}(t) = \{1 \textit{ если } a \le t < b; 0 \textit{ в противном случае}\}$$

$$X_{[1/4,1/2)}(t) = X_{[0,1/4)}(t - 1/4)$$

$$X_{[0,1/4)}(t) = X_{[0,1)}(2^2 t)$$

$$\phi(t) = X_{[0,1)}(t)$$

и определим

$$\phi_{k,j}(t) = \phi(2^k t - j) \quad j = 0,\ldots,2^k-1$$

$$f(t) = x_1\ \phi_{2,0}(t) + x_2\ \phi_{2,1}(t) + x_3\ \phi_{2,2}(t) + x_4\ \phi_{2,3}(t)$$

$$g_1(t) = a_{1,0}\,\phi_{1,0}(t) + a_{1,1}\,\phi_{1,1}(t)$$

$$\psi(t) = X_{[0,\frac{1}{2})}(t) - X_{[\frac{1}{2},1)}(t)$$

$$= \begin{cases} 1, & 0 \le t < \dfrac{1}{2}, \\ -1, & \dfrac{1}{2} \le t < 1, \\ 0, & \textit{в остальных случаях.} \end{cases}$$

$$\psi_{kj}(t) = \psi(2^k t - j), j = 0,\ldots,2^k - 1$$

$$f(t) - g_1(t) = x_2 - a_{1,0} = -d_{1,0}$$

$$f(t) = a_{1,0}\,\phi_{1,0}(t) + d_{1,0}\,\psi_{1,0}(t)$$

$$f(t) = a_{1,1}\,\phi_{1,1}(t) + d_{1,1}\,\psi_{1,1}(t)$$

$$f(t) = a_{1,0}\,\phi_{1,0}(t) + a_{1,1}\,\phi_{1,1}(t) + d_{1,0}\,\psi_{1,0}(t) + d_{1,1}\,\psi_{1,1}(t)$$

$$g_0(t) = a_{0,0}\,\phi_{0,0}(t) + d_{1,0}\,\psi_{1,0}(t) + d_{1,1}\,\psi_{1,1}(t)$$

$$f(t) - g_0(t) = x_1 - a_{0,0} - d_{1,0} = d_{0,0}$$

$$f(t) - g_0(t) = x_2 - a_{0,0} + d_{1,0} = d_{0,0}$$

$$f(t) = a_{0,0}\,\phi_{0,0}(t) + d_{0,0}\,\psi_{0,0}(t) + d_{1,0}\,\psi_{1,0}(t) + d_{1,1}\,\psi_{1,1}(t)$$

The main idea

$\{x_1, x_2, x_3, x_4\}$ - pixels

»a-average sum

$a_{10} = (x_1 + x_2)/2$

$a_{11} = (x_3 + x_4)/2$

» d-average subtraction

$d_{10} = (x_1 - x_2)/2$

$d_{11} = (x_3 - x_4)/2$

$\{x_1, x_2, x_3, x_4\} \Rightarrow \{a_{10}, a_{11}, d_{10}, d_{11}\}$

- $\{d_{10}, d_{11}\} - small\_number \Rightarrow \{a_{10}, a_{11}\}$

$a_{00} = (a_{10} + a_{11})/2$

$d_{00} = (a_{10} - a_{11})/2$

$d_{00} - аз\ сан \Rightarrow \{a_{00}\}$

$$a_{00} = (a_{10} + a_{11})/2 = ((x_1 + x_2)/2 + (x_3 + x_4)/2)/2 = (x_1 + x_2 + x_3 + x_4)/4$$

a_{00}-average.

$\{a_{00}, d_{00}, d_{10}, d_{11}\} - \{x_1, x_2, x_3, x_4\}$ – Wavelet transformatiojn

Wavelet algorithm

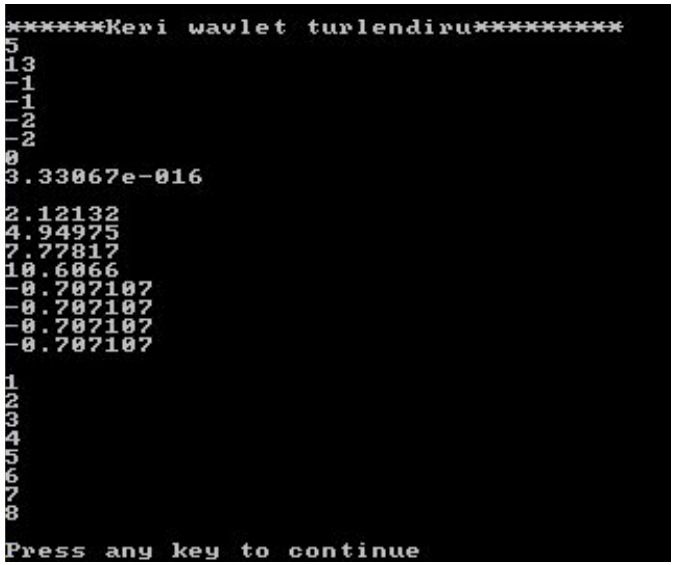
1. Wavelet transform used in the video;
2. Will be modified some of the video data coefficients (decimation);
3. You can use the remaining coefficients coding;
4. Compressed image back to back wavelet transformation.
5. Wavelet Transform:
6. Haar wavelets
7. Dobeshi wavelets (D4, D6)

$$\begin{bmatrix} A_n \\ D_n \end{bmatrix} x = \begin{bmatrix} a_{n-1} \\ d_{n-1} \end{bmatrix} \rightarrow \begin{bmatrix} A_{n-1} \\ D_{n-1} \end{bmatrix} x = \begin{bmatrix} a_{n-2} \\ d_{n-2} \end{bmatrix} \ldots \begin{bmatrix} a_0 \\ d_0 \\ d_1 \\ . \\ . \\ . \\ d_{n-1} \end{bmatrix}$$

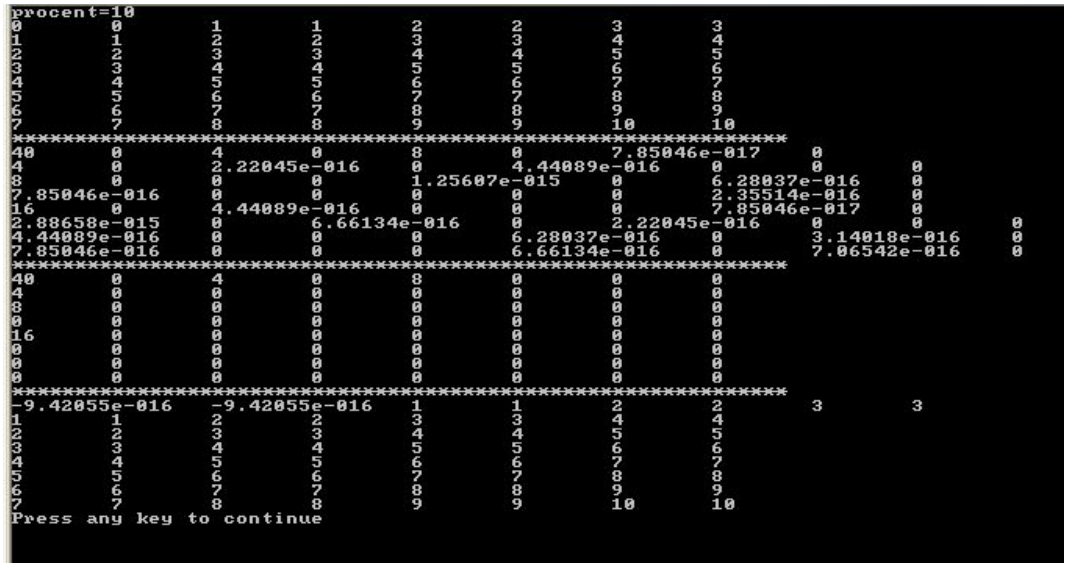
$$A_n = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 & . & . & . & . & 0 \\ 0 & 0 & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & . & . & . & 0 \\ . & . & . & . & . & . & . & . \\ 0 & . & . & . & . & 0 & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$$

$$D_{n=} \begin{bmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 & . & . & . & . & 0 \\ 0 & 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & . & . & . & 0 \\ . & . & . & . & . & . & . & . \\ 0 & . & . & . & . & 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$$

Direct wavelet conversion



Inverse wavelet conversion



Екiөлшемдi тiзбектi вейвлет түрлендiруiн қолданып сығу (10%) программасының сандық нәтижесi.

1. List ten information systems that you've used.

2. Describe how information systems help organizations fulfill their missions, deal with threats, and take advantage of opportunities.

3. Explain the differences between strategic, tactical, and operational planning. Provide an example of how a computer system might be used for each type of planning.

4. Explain the differences between structured, semi-structured, and unstructured problems. Provide an example of each type, and describe how an information system might contribute to solving the problems.

5. Using your own examples, discuss the ways in which an organization can respond to opportunities and threats.

6. Contrast and compare the characteristics of transaction processing systems, management information systems, decision support systems, and expert systems.

7. List the phases of the SDLC and the tasks that occur in each phase. Identify three development methodologies that systems analysts might use to complete the SDLC.

8. For each letter of the PIECES framework, create your own example of a problem that a systems analyst might discover in an obsolete information system.