

Knowledge Management

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IT 383
Knowledge Management

Lecture 9



Expert System

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Expert System



What is Expert System?

Expert system is a computer system that emulates the decision-making ability of a human expert.

Lecture Objectives

- 
- **Identify Expert Systems.**
 - **Understanding the advantage and limitation of the Expert Systems.**
 - **Identify Expert Systems components.**
 - **Understanding the function of each Expert System component.**
 - **Understanding the difference between problem domain and the knowledge domain**

➤ What is Expert System?

The expert system are the computer application developed to solve complex problem in particular domain, at the level of extra-ordinary human intelligence and expertise.

The expert system is a computer system that emulates the decision-making ability of a human expert.

Expert System

Expert systems solves complex problems by reasoning through knowledge, much like a domain expert.

Expert systems do not replace experts, but Make their knowledge and experience more widely available, and thus Permit non-experts to work better



➤ Important Concepts in Expert System

Expert

A human being who has developed a high level of proficiency in making judgments in a specific domain

Expertise

The set of capabilities that underlines the performance of human experts, including

- ✓ extensive domain knowledge,
- ✓ heuristic rules that simplify and improve approaches to problem solving,
- ✓ meta-knowledge and meta-cognition, and
- ✓ compiled forms of behavior that afford great economy in a skilled performance

➤ Important Concepts in Expert System

Expert

- ❑ Degrees or levels of expertise
- ❑ Nonexperts outnumber experts often by 100 to 1

Transferring Expertise

- ❑ From expert to computer to nonexperts via acquisition, representation, inferencing, transfer

➤ Important Concepts in Expert System

Inferencing

- ❑ Knowledge = Facts + Procedures (Rules)
- ❑ Reasoning/thinking performed by a computer

Rules (IF ... THEN ...)

Explanation Capability (Why? How?)

➤ The Human Element in Expert System

Expert

- ❑ Has the special knowledge, judgment, experience and methods to **give advice** and **solve problems**

Knowledge Engineer

Helps the expert(s) structure the problem area by interpreting and integrating human answers to questions, drawing analogies, posing counter examples, and enlightening conceptual difficulties

Users

➤ Advantage of Expert Systems

- **Increased availability** They are easily available due to mass production of software.
- **Reduced cost** production cost is reasonable. This makes affordable.
- **Reduced danger** They can work in the environment dangerous to human.

➤ Advantage of Expert Systems

- **Increased reliability** Error rate is low as compared to human error
- **Fast response** They offer great speed. They reduce the amount of work an individual puts in.
- **Steady** Complete responses at all times.
- **Multiple expertise.**

➤ Characteristics of Expert Systems

- High Performance
- Understandable
- Reliable
- Highly Responsive

➤ The Expert Systems are capable of :

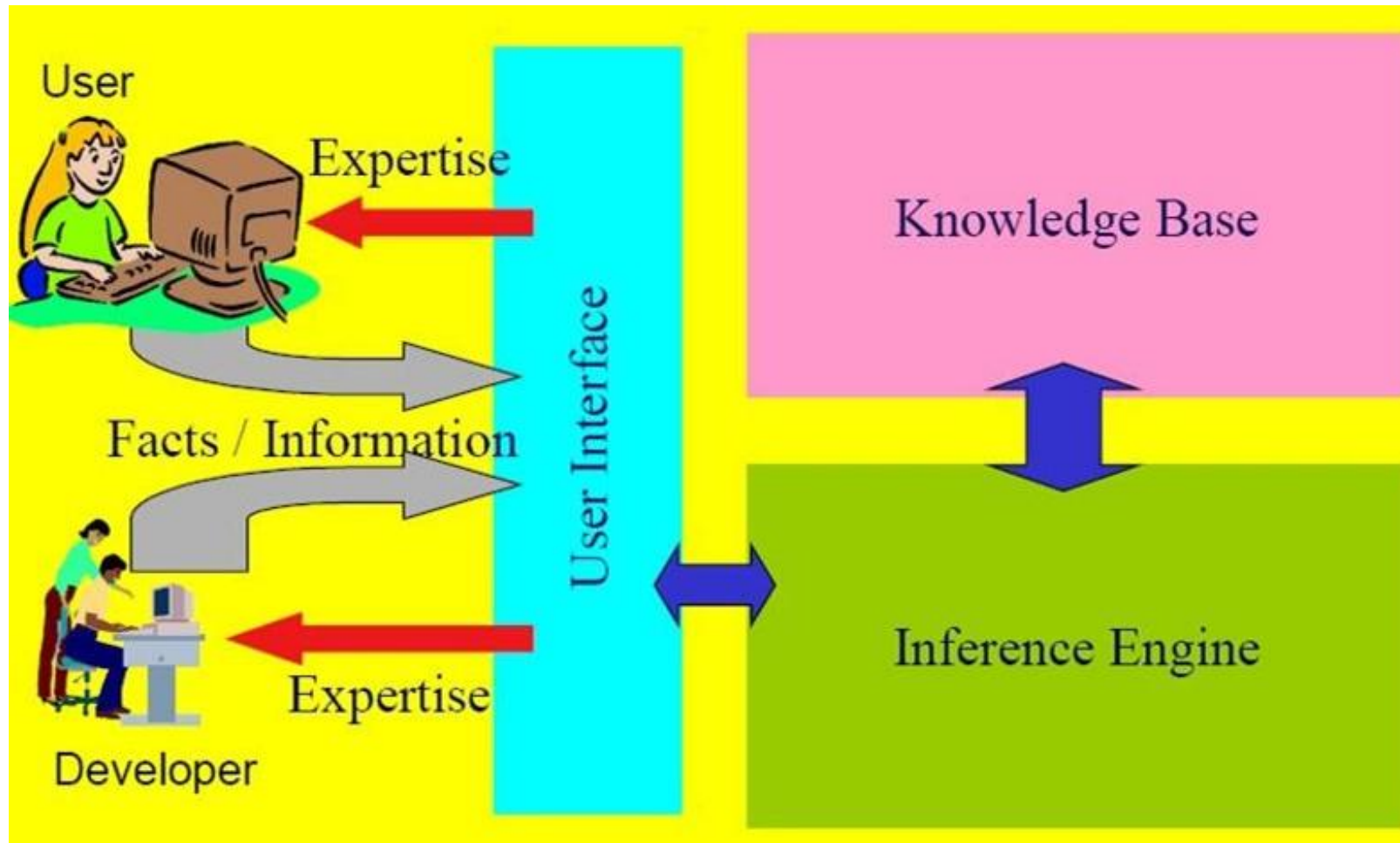
- Advising
- Instructing and assisting human in decision making.
- Demonstrating
- Deriving a solution
- Diagnosing
- Explaining
- Interpreting input
- predicting results
- Justifying the conclusion
- Suggesting alternative options to a problem

➤ **They Expert Systems are incapable of :**

- **Substituting human decision makers**
- **Processing human capabilities**
- **Reducing accurate output for inadequate knowledge base**
- **Refining their own knowledge**

Expert System

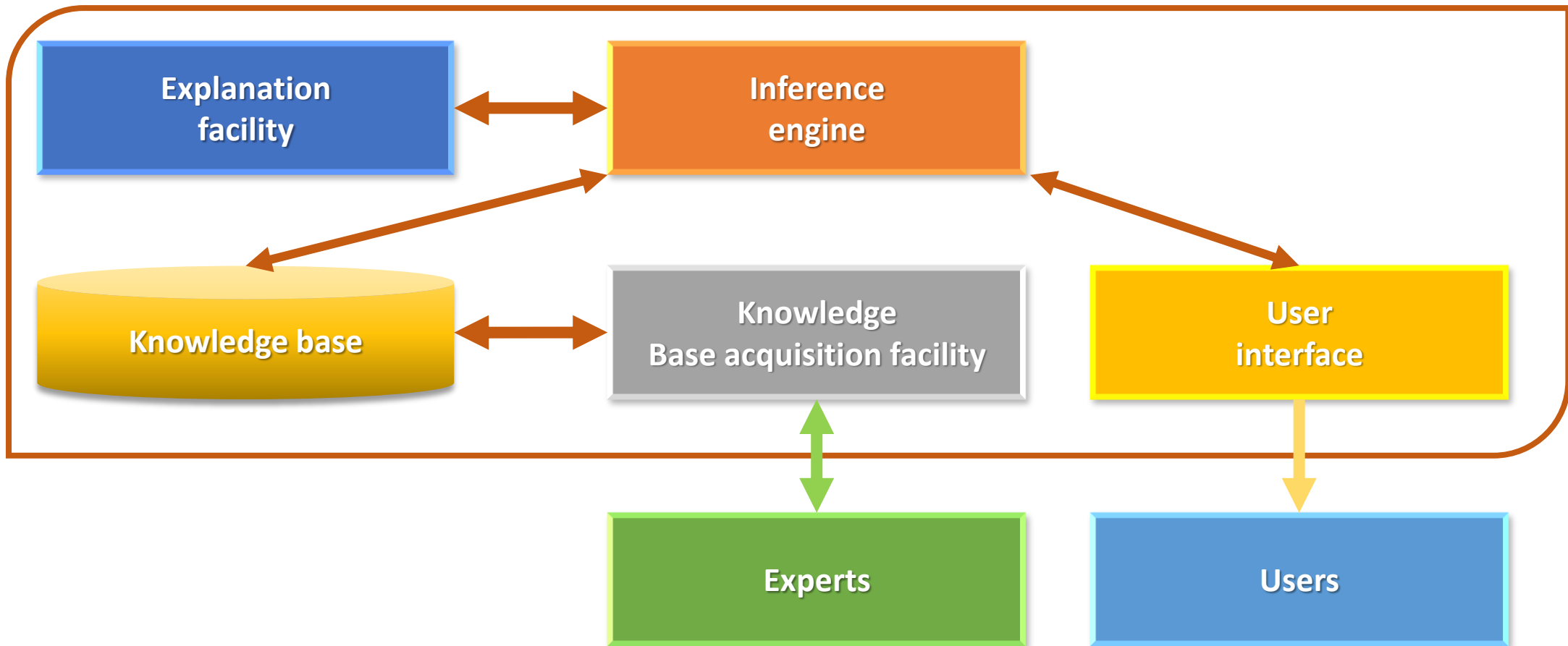
➤ Expert Systems Main Components



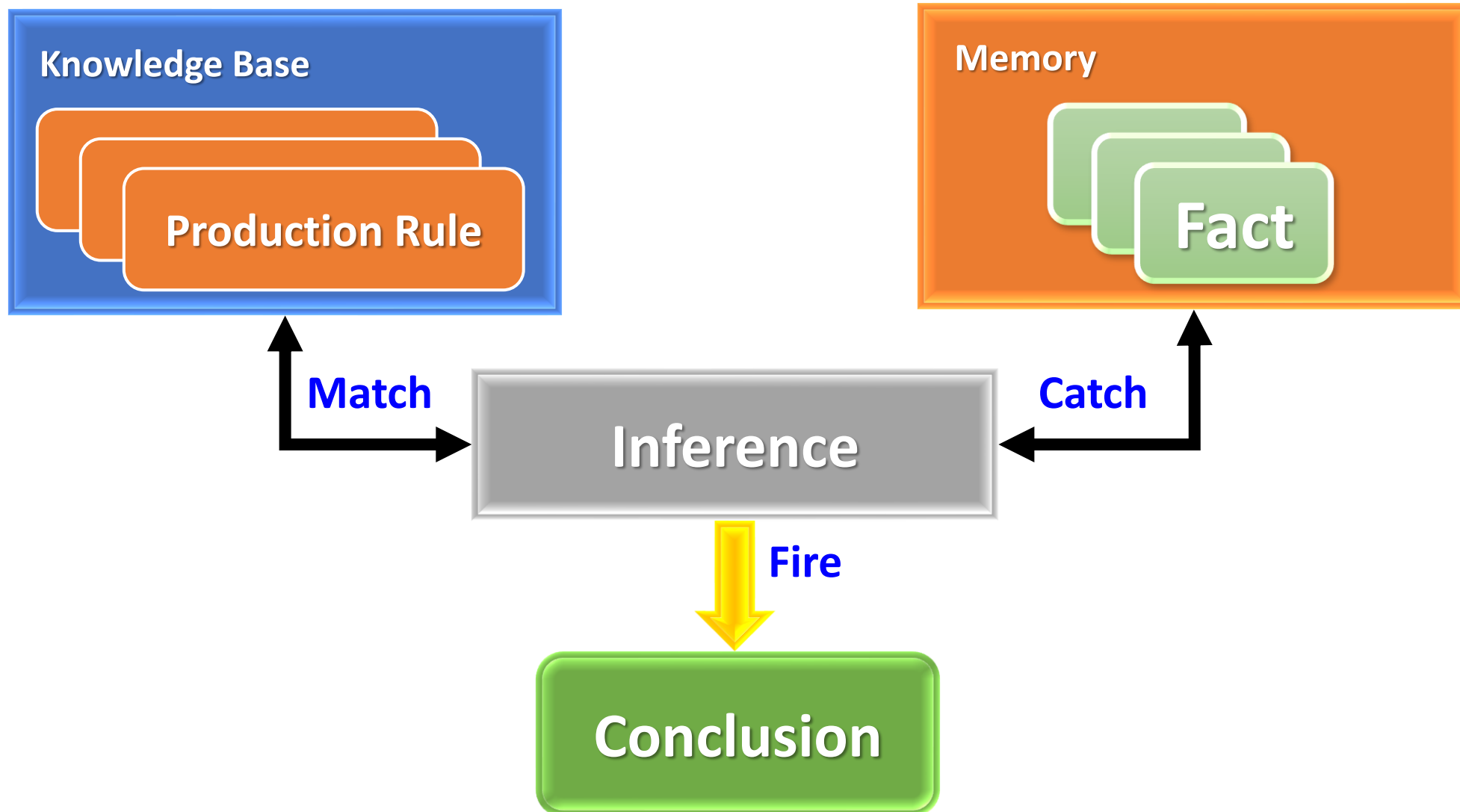
➤ Objective of Expert Systems

- To **replicate expert knowledge** in a specific field.
- To assist users in **problem-solving and decision-making**.
- To **reduce dependency** on human experts.
- To offer **consistent, fast, and cost-effective** solutions.

Expert System Component



Inference



➤ **Inference engine:**

Part of the expert system that seeks information and relationships from the knowledge base and provides answers, predictions, and suggestions similar to the way a human expert would.

➤ **Explanation Facility:**

Allows a user or decision maker to understand how the expert system arrived at certain conclusions or results.

➤ **Knowledge Acquisition Facility:**

provide a convenient and efficient means of capturing and storing all components of the knowledge base. Knowledge acquisition software can present users and decision makers with easy-to-use menus. After entering the appropriate attributes, the knowledge acquisition facility correctly stores information and relationships in the knowledge base, making the knowledge base easier and less expensive to set up and maintain.

➤ **User Interface:**

The main purpose of the user interface is to make an expert system easier for users and decision makers to develop and use.

➤ Requirements of Efficient Expert System User Interface

- It Should help users to accomplish their goals in **shortest possible way**
- It Should be designed to work for **user's existing or desired work practices**
- It technology should be **adaptable to user's requirements**; not the other way round
- It Should **make efficient** use of user input
- He user interface makes it **easy to trace the credibility of the deduction**

➤ Development of Expert System

Defining the nature and scope of the problem

- ❑ Rule-based ES are appropriate when the nature of the problem is qualitative, knowledge is explicit, and experts are available to solve the problem effectively and provide their knowledge

➤ Development of Expert System

Identifying proper experts

- ❑ **A proper expert should have a thorough understanding of:**
 - **Problem-solving knowledge**
 - **The role of ES and decision support technology**
 - **Good communication skills**

➤ Development of Expert System

Acquisition knowledge

- **Knowledge engineer**

An AI specialist responsible for the technical side of developing an expert system. The knowledge engineer works closely with the domain expert to capture the expert's knowledge

- **Knowledge engineering (KE)**

The engineering discipline in which knowledge is integrated into computer systems to solve complex problems normally requiring a high level of human expertise

➤ Development of Expert System

Selecting the building tools

- **General-purpose development environment**
- **Expert system shell** (e.g., ExSys or Corvid)...
A computer program that facilitates relatively easy implementation of a specific expert system
- **Choosing an Expert System development tool**
 - Consider the cost benefits
 - Consider the functionality and flexibility of the tool
 - Consider the tool's compatibility with the existing information infrastructure
 - Consider the reliability of and support from the vendor

➤ Development of Expert System

☐ Coding (implementing) the system

- The major concern at this stage is whether the coding (or implementation) process is properly managed to avoid errors...

☐ Assessment of an expert system

- Evaluation
- Verification
- Validation

➤ Development of Expert System - Validation and Verification of the Expert System

Evaluation

- Assess an expert system's overall value
- Analyze whether the system would be usable, efficient and cost-effective

➤ Development of Expert System - Validation and Verification of the Expert System

Validation

- Deals with the performance of the system (compared to the expert's)
- Was the “right” system built (acceptable level of accuracy?)

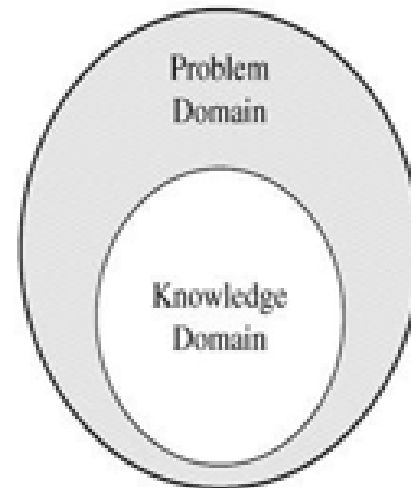
➤ Development of Expert System - Validation and Verification of the Expert System

Verification

- Was the system built "right"?
- Was the system correctly implemented to specifications?

➤ Problem Domain Vs. Knowledge Domain

- An expert's knowledge is specific to **one domain problem** – medicine, finance, etc.
- The expert's knowledge about **Solving specific problem** is called the knowledge domain.
- The **problem domain** is always a superset of the knowledge domain.



➤ How to decide the appropriate domain?

- Can the problem be solved by conventional programming?
- Is the domain well bounded?
- Is there a need for an expert system?
- Is there at least one human expert willing to help?
- Can the expert explain his knowledge so that the knowledge engineer can understand it?
- Is the knowledge mainly uncertain?

➤ Expert System Success Factor

Most Critical Factors

- ☐ Having a Champion in Management
- ☐ User Involvement and Training
- ☐ Justification of the Importance of the Problem
- ☐ Good Project Management

➤ Limitation of Expert System Success

- ☐ Limitation of the technology
- ☐ Difficult knowledge acquisition
- ☐ High development costs
- ☐ Limited knowledge
- ☐ Mechanical Reasoning

Summary

- **Understanding Expert System.**
- **Understanding the advantage and limitation of the Expert Systems**
- **Understanding Expert Systems components.**
- **Understanding the function of each Expert System component.**
- **Understanding the difference between problem domain and the knowledge domain.**



Thank You