



**CS607- Artificial Intelligence**  
**Solved Subjective**  
**From Midterm Papers**

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PSMD01

**MIDTERM EXAMINATION**  
**Fall 2012**  
**CS607- Artificial Intelligence**

**Q1 - Differentiate between Mutation and Crossover. (2 Marks)**

**Answer:- (Page 81)**

In Mutation, each “Individual” (or “solution”) has one parent.

In Inheritance or Crossover, each “Individual” (or “solution”) has two parents.

**Q2- Write CLIPS command for "remove only Facts". (2 Marks)**

**Answer:- (Page 134)**

The retract command is used to remove or retract facts. For example:

(retract 1) removes fact 1

(retract 1 3) removes fact 1 and 3

**Q3- Bike is heavy! This statement is uncertain fact or not? Elaborate. (3 Marks)**

**Answer:- (Page 94)**

No, this statement belongs to Fuzzy facts. Fuzzy facts are ambiguous in nature, e.g. the book is heavy/light.

Here it is unclear what heavy means because it is a subjective description. Fuzzy representation is used for such facts. While defining fuzzy facts, we use certainty factor values to specify value of “truth”. We will look at fuzzy representation in more detail later.

**Q4- Elaborate the importance of Knowledge Base in ES. (3 Marks)**

**Answer:- (Page 117)**

The knowledge base is the part of an expert system that contains the domain knowledge, i.e.

- Problem facts, rules
- Concepts
- Relationships

As we have emphasized several times, the power of an ES lies to a large extent in its richness of knowledge. Therefore, one of the prime roles of the expert system designer is to act as a knowledge engineer. As a knowledge engineer, the designer must overcome the knowledge acquisition bottleneck and find an effective way to get information from the expert and encode it in the knowledge base, using one of the knowledge representation techniques we discussed in KRR.

دنیا میں سب سے مشکل کام اپنی اصلاح اور سب سے آسان کام دوسروں پر نکتہ چینی کرنا ہے

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### Q5- Conflict Resolution Strategies (5 Marks)

**Answer:- (Page 126)**

To overcome the conflict problem stated above, we may choose to use one of the following conflict resolution strategies:

- Fire first rule in sequence (rule ordering in list). Using this strategy all the rules in the list are ordered (the ordering imposes prioritization). When more than one rule matches, we simply fire the first in the sequence
- Assign rule priorities (rule ordering by importance). Using this approach we assign explicit priorities to rules to allow conflict resolution.
- More specific rules (more premises) are preferred over general rules. This strategy is based on the observation that a rule with more premises, in a sense, more evidence or votes from its premises, therefore it should be fired in preference to a rule that has less premises.
- Prefer rules whose premises were added more recently to WM (timestamping). This allows prioritizing recently added facts over older facts.
- Parallel Strategy (view-points). Using this strategy, we do not actually resolve the conflict by selecting one rule to fire. Instead, we branch out our execution into a tree, with each branch operation in parallel on multiple threads of reasoning. This allows us to maintain multiple view-points on the argument concurrently

### Q6- "Riding a Horse is same as Riding a Donkey" , This Statement belongs which reasoning...elaborate it (5 Marks)

**Answer:- (Page 89)**

This statement belongs to Knowledge Representation and Reasoning. Knowledge representation (KR) and reasoning are closely coupled components; each is intrinsically tied to the other. A representation scheme is not meaningful on its own; it must be useful and helpful in achieve certain tasks. The same information may be represented in many different ways, depending on how you want to use that information. For example, in mathematics, if we want to solve problems about ratios, we would most likely use algebra, but we could also use simple hand drawn symbols. To say half of something, you could use  $0.5x$  or you could draw a picture of the object with half of it colored differently. Both would convey the same information but the former is more compact and useful in complex scenarios where you want to perform reasoning on the information. It is important at this point to understand how knowledge representation and reasoning are interdependent components, and as AI system designer, you have to consider this relationship when coming up with any solution.

برى صحبت سے تنہائی بہتر ہے اور تنہائی سے نیک صحبت بہتر ہے

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**MIDTERM EXAMINATION**  
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**1. GA using mutation procedure of 32-bit word that have first 16 bits 0s and last 16-bits 1s**

**2. step by step procedure of backward chaining (5 Marks)**

**Answer:- (Page 126)**

1. Start with the goal.
2. Goal may be in WM initially, so check and you are done if found!
3. If not, then search for goal in the THEN part of the rules (match conclusions, rather than premises). This type of rule is called goal rule.
4. Check to see if the goal rule's premises are listed in the working memory.
5. Premises not listed become sub-goals to prove.
6. Process continues in a recursive fashion until a premise is found that is not supported by a rule, i.e. a premise is called a primitive, if it cannot be concluded by any rule
7. When a primitive is found, ask user for information about it. Back track and use this information to prove sub-goals and subsequently the goal.

**1. how knowledge representation and reasoning is closely coupled and independent too in AI cycle (3 Marks)**

**Answer:- (Page 89) Rep**

Knowledge representation (KR) and reasoning are closely coupled components; each is intrinsically tied to the other. A representation scheme is not meaningful on its own; it must be useful and helpful in achieve certain tasks. The same information may be represented in many different ways, depending on how you want to use that information. For example, in mathematics, if we want to solve problems about ratios, we would most likely use algebra, but we could also use simple hand drawn symbols. To say half of something, you could use  $0.5x$  or you could draw a picture of the object with half of it colored differently. Both would convey the same information but the former is more compact and useful in complex scenarios where you want to perform reasoning on the information. It is important at this point to understand how knowledge representation and reasoning are interdependent components, and as AI system designer, you have to consider this relationship when coming up with any solution.

**2. structure of Expert system explain the analogy with the real world example (3 Marks)**

**Answer:- (Page 115)**

Having discussed the scenarios and applications in which expert systems may be useful, let us delve into the structure of expert systems. To facilitate this, we use the analogy of an expert (say a doctor) solving a problem. The expert has the following:

- Focused area of expertise
- Specialized Knowledge (Long-term Memory, LTM)
- Case facts (Short-term Memory, STM)
- Reasons with these to form new knowledge
- Solves the given problem

خدا کے سوا کسی سے امید مت رکھو

**1. "defrule" in CLIPS syntax and example** (2 Marks)

**Answer:- (Page 135)**

We enter this into CLIPS using the following construct:

```
;Rule header
(defrule isSon "An example rule"
; Patterns
(father (fathersName "ali") (sonsName "ahmed"))
;THEN
=>
;Actions
(assert (son (sonsName "ahmed") (fathersName "ali")))
)
```

**2. Shallow and structural knowledge?** (2 Marks)

**Answer:- (Page 90)**

**Heuristic knowledge:** Rule-of-thumb, e.g. if I start seeing shops, I am close to the market.

- Heuristic knowledge is sometimes called shallow knowledge.
- Heuristic knowledge is empirical as opposed to deterministic

**Structural knowledge:** Describes structures and their relationships. e.g. how the various parts of the car fit together to make a car, or knowledge structures in terms of concepts, sub concepts, and objects.

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**which is the best memory of all memory types and why it is different from knowledge base (5 Marks)**

**which is the best knowledge and why** (5 Marks)

**Answer:- (Page 91)**

Each type of representation has its benefits. What types of knowledge is best represented using pictures? , e.g. can we represent the relationship between individuals in a family using a picture? We could use a series of pictures to store procedural knowledge, e.g. how to boil an egg. But we can easily see that pictures are best suited for recognition tasks and for representing structural information. However, pictorial representations are not very easily translated to useful information in computers because computers cannot interpret pictures directly with out complex reasoning. So even though pictures are useful for human understanding, because they provide a high level view of a concept to be obtained readily, using them for representation in computers is not as straight forward.

اللہ کا خوف سب سے بڑی دانائی ہے



which system is used to model human beings (2 marks)

**Answer:- (Page 111)**

expert system

which is better in terms of cost, expert system or human expert (2 marks)

**Answer:- (Page 113)**

In terms of cost expert system is better as it has low cost.

difference between meta knowledge and heuristic knowledge(3 marks)

**Answer:- (Page 90)**

**Meta knowledge:** Knowledge about knowledge, e.g., the knowledge that blood pressure is more important for diagnosing a medical condition than eye color.

**Heuristic knowledge:** Rule-of-thumb, e.g. if I start seeing shops, I am close to the market.

- Heuristic knowledge is sometimes called shallow knowledge.
- Heuristic knowledge is empirical as opposed to deterministic

conventional system and expert systems ka difference(3-marks)

**Answer:- (Page 122)**

An expert system is different from conventional programs in the sense that program control and knowledge are separate. We can change one while affecting the other minimally. This separation is manifest in ES structure; knowledge base, working memory and inference engine. Separation of these components allows changes to the knowledge to be independent of changes in control and vice versa.

## MIDTERM EXAMINATION

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1: diff between monotonic and non monotonic reasoning?

**Answer:- (Page 104)**

Non-Monotonic reasoning is used when the facts of the case are likely to change after some time, e.g.

Rule:

IF the wind blows

THEN the curtains sway

When the wind stops blowing, the curtains should sway no longer. However, if we use monotonic reasoning, this would not happen. The fact that the curtains are swaying would be retained even after the wind stopped blowing. In non monotonic reasoning, we have a 'truth maintenance system'. It keeps track of what caused a fact to become true. If the cause is removed, that fact is removed (retracted) also.

ایماندار کو غصہ دیر سے آتا ہے اور جلدی دور ہو جاتا ہے

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**2: name 2 languages used in AI?**

**Answer:- (Page 10)**

Lisp

Microworlds

**3: which components of experts system are tightly coupled?**

**Answer:- (Page 89)**

Knowledge representation (KR) and reasoning are closely coupled components; each is intrinsically tied to the other.

**4: Forward chaining and its approach?**

**Answer:- (Page 123)**

#### **Forward Chaining**

Let's look at how a doctor goes about diagnosing a patient. He asks the patient for symptoms and then infers diagnosis from symptoms. Forward chaining is based on the same idea. It is an "inference strategy that begins with a set of known facts, derives new facts using rules whose premises match the known facts, and continues this process until a goal state is reached or until no further rules have premises that match the known or derived facts" (Durkin). As you will come to appreciate shortly, it is a data-driven approach.

#### **Approach**

1. Add facts to working memory (WM)
2. Take each rule in turn and check to see if any of its premises match the facts in the WM
3. When matches found for all premises of a rule, place the conclusion of the rule in WM.
4. Repeat this process until no more facts can be added. Each repetition of the process is called a pass.

**5: Which is best in learning ability of human expert and expert system?**

**Answer:- (Page 113)**

Learning ability of human expert is best.

**6. Describe Appropriate Domains for Expert System? 5 marks**

**Answer:- (Page 115)**

When analyzing a particular domain to see if an expert system may be useful, the system analyst should ask the following questions:

- Can the problem be effectively solved by conventional programming? If not, an ES may be the choice, because ES are especially suited to illstructured problems.
- Is the domain well-bounded? e.g. a headache diagnosis system may eventually have to contain domain knowledge of many areas of medicine because it is not easy to limit diagnosis to one area. In such cases where the domain is too wide, building an ES may not be a feasible proposition.
- What are the practical issues involved? Is some human expert willing to cooperate? Is the expert's knowledge especially uncertain and heuristic? If so, ES may be useful.

زندگی میں کامیابی کا پہیہ راز ہے کہ پریشانیوں سے پریشان مت بنو

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**1. Issues in Forward chaining? 2 marks**

**Answer:- (Page 125)**

Undirected search

Conflict resolution

Conflict resolution strategies

**3. Convert this to CNF  $(A \vee B) \rightarrow (C \rightarrow D)$  ? 3 marks**

**Answer:- (Page 108)**

$$(A \vee B) \rightarrow (C \rightarrow D)$$

$$1. \neg(A \vee B) \vee (\neg C \vee D)$$

$$2. (\neg A \wedge \neg B) \vee (\neg C \vee D)$$

$$3. (\neg A \vee \neg C \vee D) \wedge (\neg B \vee \neg C \vee D)$$

**4. In Adversarial Search evaluation function is used to score / number the nodes? Do you agree or not.**

**Give Reason 3 marks**

**Answer:- (Page 63)**

If we have a situation analyzer that converts all judgments about board situations into a single, over all quality number. This situation analyzer is also called a static evaluator and the score/ number calculated by the evaluator is called the static evaluation of that node. Positive numbers, by convention indicate favor to one player. Negative numbers indicate favor to the other player. The player hoping for positive numbers is called maximizing player or maximizer. The other player is called minimizing player or minimizer.

**6: Is perception and knowledge representation are tightly coupled? Yes or not and why?**

**Answer:- (Page 89)**

An AI system has a perception component that allows the system to get information from its environment. As with human perception, this may be visual, audio or other forms of sensory information. The system must then form a meaningful and useful representation of this information internally. This knowledge representation maybe static or it may be coupled with a learning component that is adaptive and draws trends from the perceived data.

عقل مند کہتا ہے میں کچھ نہیں جانتا جبکہ بے وقوف کہتا ہے کہ میں سب کچھ جانتا ہوں

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