CS 4201 Expert System(corrective)– 2019/2020	Handout: Revision

Multiple choice questions(MCQ):

1. Which condition is used to cease the growth of forward chaining?
   A. Atomic sentences B. Complex sentences
   C. No further inference D. Data-driven, data-driven
   Answer: C
2. An _____ system has a stored knowledge base and an inference engine.
   A. expert B. centers
   C. control D. MIS
   Answer: A

3. _____ attempt to provide the same judgmental advice that human experts such as doctors provide.
   A. ES B. AI
   C. KBS D. RAND
   Answer:A

4. Diagnosing an illness using MYCIN system is an example of:
   A. Decision Support System B. Expert System
   C. Neural Network D. None of the above
   Answer: B

5. Forward chaining systems are ____ where backward chaining systems are _____
   A. Goal-driven, goal-driven B. Goal-driven, data-driven
   C. Data-driven, goal-driven D. Data-driven, data-driven
   Answer:C

6. Which of the following artificial intelligence programs is often used to understand handwriting in applications like PDAs?
   A. Expert System B. Decision Support System
   C. Neural Network D. Genetic Algorithm
   Answer:C
7. If-Then-Else logic is used in
   A. Genetic Algorithm
   B. Decision Support System
   C. Neural Network
   D. Expert System
   Answer: D

8. A _____ provides a set of integrated computer tools that allow a decision maker to interact directly with computers in order to retrieve information useful for semi-structured and unstructured decisions,

A. DDS B. Intelligent DBMS
C. MIS D. Control
Answer:A

9. A knowledge-intensive computer program that captures the expertise of a human in limited domains of knowledge describes:
A. virtual reality B. a neural network
C. a decision support system D. an expert system
Answer:D

10. --------, which are primarily intended for heuristic knowledge based on experience.
A. Rules B. facts
C. rules and facts D. *Deffunctions*
Answer:A

11. What can expert systems do?
A. Use common sense B. Use judgment
C. Automate everything D. None of the above
Answer:D

12. Which of the following is a specialist who elicits information and expertise from other professionals and translates it into a set of rules or frames for an expert system?
A. Knowledge translator B. Knowledge analyst
C. Knowledge specialist D. Knowledge engineer
Answer: D

13. Expert system benefits include reduced errors, reduced cost, reduced training time, improved decisions, and improved quality and service.
A. True B. False
Answer: A

14. Which phase of decision making finds or recognizes a problem, need, or opportunity?
A. Intelligence B. Design
C. Choice D. Implementation

Answer: A

15. An expert system can be used for medical diagnosis by giving symptoms and trying to determine what is wrong.
A. True B. False

Answer: A

16. Expert systems are adaptive systems that work independently, carrying out specific, repetitive, or predicable tasks.
A. True B. False

Answer: B

17. If expert system recognizes a new pattern it can set up a rule based on it.
    A. True B. False
    Answer: B

Questions:

1. How will the expert system be maintained and evolve?
   Answer:
   Expert System development and maintenance include:
   a) problem Identification
   b) System design and ES technology identification
   c) development of prototype
   d) testing and refinement of prototype
   e) complete and field the expert system
   f) maintain the system

2. What's meant by **conflict resolution**? What is on the **Agenda**?
   Answer:
   - **Conflict resolution:**
     When it is needed?
     Conflicts arise in the chaining when 2 rules lead to the same conclusion (consequent) and to resolve conflict a strategy is needed.
     What does it mean?
     Conflict resolution strategies are used in rule-based expert systems, to help in choosing which production rule to fire. The need for such a strategy arises when the conditions of two or more rules are satisfied by the currently known facts
     Different strategies?
     There are seven conflict resolution strategies in CLIPS: depth, breadth, simplicity, complexity, lex, mea, and random. The default strategy is depth in CLIPS.
     This is more details if you need
     1- Depth Strategy
     Newly activated rules are placed above all rules of the same salience. For example, given that fact activates rule1 and rule2 and factb activates rule3 and rule4, then if fact is asserted before fact b, rule3 and rule4 will

be above rule1 and rule2 on the agenda. However, the position of rule1 relative to rule2 and rule3 relative to rule4 will be arbitrary.

2 Breadth Strategy

Newly activated rules are placed below all rules of the same salience. For example, given that facta activates rule1 and rule2 and factb activates rule3 and rule4, then if facta is asserted before factb, rule1 and rule2 will be above rule3 and rule4 on the agenda. However, the position of rule1 relative to rule2 and rule3 relative to rule4 will be arbitrary.

3 Simplicity Strategy

Among rules of the same salience, newly activated rules are placed above all activations of rules with equal or higher specificity. The **specificity** of a rule is determined by the number of comparisons that must be performed on the LHS of the rule. Each comparison to a constant or previously bound variable adds one to the specificity. Each function call made on the LHS of a rule as part of the :, =, or test conditional element adds one to the specificity. The boolean functions **and**, **or**, and **not** do not add to the specificity of a rule, but their arguments do. Function calls made within a function call do not add to the specificity of a rule. For example, the following rule

```
(defrule example
  (item ?x ?y ?x)
  (test (and (numberp ?x) (> ?x (+ 10 ?y)) (< ?x 100)))
  =>)
```

has a specificity of 5. The comparison to the constant item, the comparison of ?x to its previous binding, and the calls to the **numberp**, **<**, and **>** functions each add one to the specificity for a total of 5. The calls to the **and** and **+** functions do not add to the specificity of the rule.

4 Complexity Strategy

Among rules of the same salience, newly activated rules are placed above all activations of rules with equal or lower specificity.

5 LEX Strategy

6 MEA Strategy

- **Agenda**: CLIPS attempts to match the patterns of rules against facts in the fact-list. If all the patterns of a rule match facts, the rule is **activated** and put on the agenda. The agenda is a collection of activations which are

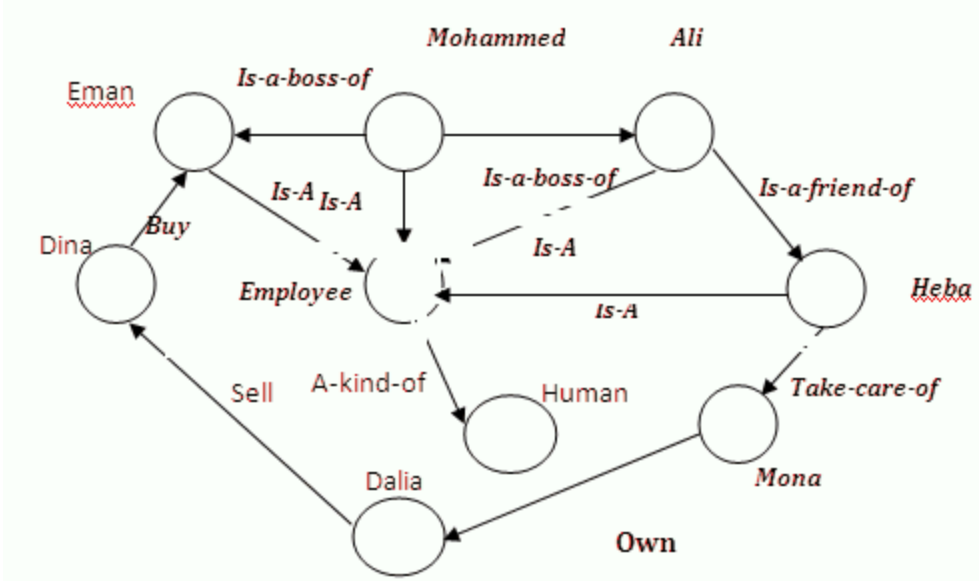
those rules which match pattern entities. Zero or more activations may be on the agenda.

3. Given the following **deftemplates** describing a family tree,Write the suitable rules to build the relations (Uncle, Sister, grandparent):
   (deftemplate father-of (slot father) (slot child))
   (deftemplate mother-of (slot mother) (slot child))
   (deftemplate male (slot person))
   (deftemplate female (slot person))
   (deftemplate wife-of (slot wife) (slot husband))
   (deftemplate husband-of (slot husband) (slot wife))

   Answer:

```
(defrule parent-rule
(or (father-of (father ?x)(child ?y))
    (mother-of(mother ?x)(child ?y))
=>(assert (parent ?x ?y)
)
(defrule grandparent
(and(parent ?x?y)(parent ?y ?z))
=>(assert (grandparent ?x ?z))
)
```

4. Using **CLIPS** define the facts and rules to build semantic net?



Answer:

```
(deffacts semanticnet
        (is-a  eman  employee)
        (is-a mohamed employee)
        (is-a ali employee)
        (is-a heba employee)
        (A-kind-of  employee human)
        (buy dina eman)
        (sell dalia dina)
        (own mona dalia)
        (take-care-of  heba mona)
        (is-a-friend-of ali heba)
        (is-a-boss-of mohamed ali)
        (is-a-boss-of mohamed eman))
 (defrule human
    (is-a  ?name employee)
=>(assert (A-kind-of  ?name  human)))
(defrule  friends
    (is-friend-of    ?name1  ?name2)
    =>(assert (is-friend-of  ?name2  ?name1)))
```

5. Define a CLIPS rule for the following pseudo code?

IF the animal is a dog
THEN the sound made is woof.

Answer:

(defrule sound

(test animal)

=> assert (the_sound _made woof))

Or

(defrule sent-rule

(animal dog)

=> (printout "sound made is woof"))

or

(defrule sent-rule

(animal dog)

=>(assert (made_sound woof)))

6. What happens if you define two rules in CLIPS both called “dog?”
   Answer:
   The second rule overwrites the first.

7. Compare between Production Rules and Semantic nets?
   Answer:

Advantages and Disadvantages of Production Rules:

Advantages:

- **simple and easy to understand**
- **straightforward implementation**
- **formal foundations for some variants**

Disadvantages:

- **simple implementations are very inefficient**
- **some types of knowledge are not easily expressed in such rules**
- **large sets of rules become difficult to understand and maintain**

Problems with Semantic Nets:

Disadvantages of semantic nets could be classified as:

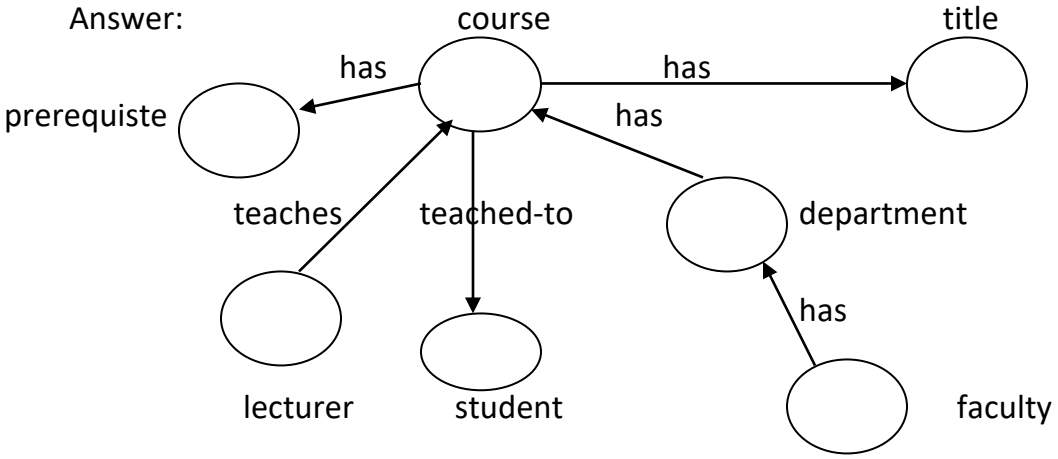
- **Expressiveness**
  - **no internal structure of nodes**
  - **relationships between multiple nodes**
  - **no easy way to represent heuristic information**
  - **extensions are possible, but cumbersome**
  - **best suited for binary relationships**
- **Efficiency**

- **may result in large sets of nodes and links**
- **search may lead to combinatorial explosion**
  - **especially for queries with negative results**

- **Usability**
  - **lack of standards for link types**
  - **naming of nodes**
    - **classes, instances**

8. Create a semantic network to describe a University course. Your network should include the concepts: course, title, department, faculty, student, lecturer and pre-requisite.

   Answer:



9. Draw a frame system in which you are attending classes. Consider offices, classrooms, laboratories?

   Answer:

SLOTS	FILLERS (office frame)
name	office
specialization_of	AKO room
location	(North, East, South, West)
floor_number	(1, 2, 3)
owner	(department)
assigned_to	(department, instructor)

SLOTS	FILLERS (instantiated office frame)
name	Room 523
specialization_of	ISA office
location	East
floor_number	3
owner	Computer Science
assigned_to	Prof. A. Miller

SLOTS	FILLERS (classroom frame)
name	classroom
specialization_of	AKO room
location	(North, East, South, West)
floor_number	(1, 2, 3)
seating_capacity	(maximum number of desks)
square_footage	(size)

seating_capacity	(maximum number of desks)
square_footage	(size)

SLOTS	FILLERS (instantiated classroom frame)
name	Room 310
specialization_of	ISA classroom
location	South
floor_number	3
seating_capacity	42
square_footage	630

Complete:

1. **____ is the study of making valid inferences.**
   Answer: Logic

2. An attorney pleading a case for his client innocence would be using (formal, inform) logic.

Answer: informal

3. _____ refers to giving meaning to symbols.

Answer: Semantics

4. Using one's experience to solve a problem is referred to as ____ .

Answer: heuristics

5. Epistemology is the study of _____.

Answer: knowledge

6. A mile is 5280 feet is an example of _____ knowledge.

Answer: a priori

7. "Don't stand in the middle of a busy street" is an example of _____ knowledge.

Answer: declarative

8 When expert systems reach conclusions, we use the term (inferencing, reasoning), but when humans reach conclusions, we use the term ----------

Answer: inferencing, reasoning

9. _____ is knowledge about knowledge and expertise.

Answer: Metaknowledge

10. Syntax refers to (form, meaning), while semantics refers to (form, meaning).

Answer: form, meaning

11. A set of terminals is called a(n) _____ of the language.

Answer: string

12. A compiler creates a(n) _____ tree when it tries to determine if statements in a program conform to valid syntax rules.

Answer: parse

13. Compilers translate source code into units of smallest meaning, called _____.

Answer: tokens

14. The structure of a semantic set is shown graphically in terms of _____ and _____ connecting them.

Answer: nodes, arcs

15. Two commonly used links are _____ and _____.

Answer: IS-A, A-KIND-OF

16. The expert system MYCIN used a type of knowledge representation called a(n) _____ triplet.

Answer: object-attribute-value

17. In PROLOG, the symbol _____ means IF.

Answer: :-

18. A PROLOG interpreter will try to satisfy subgoals by conducting a(n) _____ search.

Answer: depth-first

19. XML stands for _____ _____ _____.

Answer: Extensible markup language

20. A(n) _____ is a group of slots and fillers that defines a stereotypical object.

Answer: frame