Unit1:

Information is obtained by processing of data in a way that is meaningful and useful to humans.

Knowledge is acquired after understanding information. Understanding is attained after the development of a detailed or long term relationship with the given thing. (Kendel & Creen, 2007)

A second language in which you are fluent.

This would be knowing. The word ‘fluent’ indicates there is a long term relationship with the language and have good understanding.

The content of a television news programme.

This would be information if the person is listening to the programme as a spectator. But would be knowledge, if the person was involved in producing the programme content.

A close friend.

This would be knowing. Close friend indicates a long-term relationship and understanding with the person.

A company’s annual report.

This would be information if the person was not involved in producing the report. But would be knowledge, if the person was involved in producing the annual report content and has good understanding about its contents.

Your close friend’s partner whom you have yet to meet.

This would be information. From the term ‘yet to meet’, it is clear there is no understanding about the friend’s partner.

The weather on the other side of the world.

This would be information. It is clear that the person is not present at that location and have no understanding.

The weather where you are now.

This would be knowing, as the term ‘ where you are now’ indicates the current weather at your location, which you can understand by just looking out at the sky.

Kendel & Creen (2007) An Introduction to knowledge engineering. Springer.

Unit2

1. Given the following sets:

$A = \{a, b, c, 2, 3, 4\}$ $E = \{a, b, \{c\}\}$

$B = \{a, b\}$ $F = \emptyset$

$C = \{c, 2\}$ $G = \{\{a, b\}, \{c, 2\}\}$

$D = \{b, c\}$

classify each of the following statements as true or false

(a) $c \in A$ True **(g)** $D \subset A$ True **(m)** $B \subseteq G$ True

(b) $c \in F$ False **(h)** $A \subseteq C$ False **(n)** $\{B\} \subseteq G$ False

(c) $c \in E$ False **(i)** $D \subseteq E$ False **(o)** $D \subseteq G$ False

(d) $\{c\} \in E$ True **(j)** $F \subseteq A$ True **(p)** $\{D\} \subseteq G$ False

(e) $\{c\} \in C$ False **(k)** $E \subseteq F$ False **(q)** $G \subseteq A$ False

(f) $B \subseteq A$ True **(l)** $B \in G$ True **(r)** $\{\{c\}\} \subseteq E$ True

4. Consider the following sets:

$$
\begin{array}{lcllcl}
S1 & = & \{\{\emptyset\}, \{A\}, A\} & S6 & = & \emptyset \\
S2 & = & A & S7 & = & \{\emptyset\} \\
S3 & = & \{A\} & S8 & = & \{\{\emptyset\}\} \\
S4 & = & \{\{A\}\} & S9 & = & \{\emptyset, \{\emptyset\}\} \\
S5 & = & \{\{A\}, A\} & & &
\end{array}
$$

Answer the following questions Remember that the members of a set are the items separated by commas, if there is more than one, between the outermost braces only; a subset is formed by enclosing within braces zero or more of the members of a given set, separated by commas.

(a) Of the sets $S1$ - $S9$ which are members of $S1$? S2, S3, S7

(b) which are subsets of $S1$? S3, S4, S5, S6, S7

(c) which are members of $S9$? S6, S7

(d) which are subsets of $S9$? S6, S7

(e) which are members of $S4$? S3

(f) which are subsets of $S4$? S3, S6

Unit 2: Truth table activities

P	Q	~ P	P ∧ Q	P ∨ Q	P → Q	P ←→ Q	P → (~ Q)	(~ Q) -> (~ P)
F	F	T	F	F	T	T	T	T
F	T	T	F	T	T	F	T	T
T	F	F	F	T	F	F	T	F
T	T	F	T	T	T	T	F	T

P	Q	P XOR Q	~ (P ∧ Q)	(P → Q) ∧ (Q → P)
F	F	F	T	T
F	T	T	T	F
T	F	T	T	F
T	T	F	F	T

P	Q	R	P ∨ (Q ∧ R)	P ∨ (Q ∨ R)	(P ∨Q) ∨ R
F	F	F	F	F	F
F	F	T	F	T	T

F	T	F	F	T	T
F	T	T	T	T	T
T	F	F	T	T	T
T	F	T	T	T	T
T	T	F	T	T	T
T	T	T	T	T	T

Unit5

Activity 1

Bimba, A.T., Idris, N., Al-Hunaiyyan, A., Mahmud, R.B., Abdelaziz, A., Khan, S. & Chang, V. (2016) Towards knowledge modeling and manipulation technologies: A survey. International Journal of Information Management 36(6): 857–871.

1) linguistic knowledge base - represent knowledge by lexical and semantic relationships

2) expert knowledge base – represent knowledge by logical and fuzzy rules

3) ontology - represent knowledge as a taxonomy of concepts with their attributes, values and relations

4) cognitive knowledge base - . It has a logical model, a linguistic knowledge base and an object-attribute-relation which is similar to attribute, values and relations of concepts in an ontology

Activity 2

Leydesdorff, L. (2010) The knowledge-based economy and the triple helix model. Annual Review of Information Science and Technology 44(1): 365–417.

Knowledge based economy and the triple helix model

In this article, the author had argued that in addition to the two traditional mechanisms that drive a country's economy such as the economic exchange and political exchange, a third mechanism which is knowledge production and control are expected to co-ordinate among themselves to generate a knowledge base within a system

The Triple Helix is a model which enables us to recombine sociological notions of meaning processing, economic theorising about exchange relations, and insights from science and technology studies regarding the organization and control of knowledge production.

Activity 3

Fensel, D., Harmelen, V. F., Klein, M. & Akkermans, H. (2000) On-To-Knowledge: Ontology-based Tools for Knowledge Management. Amsterdam: Free University Amsterdam VUA, Division of Mathematics and Informatics.

The components of the Onto Knowledge model/ framework are the user interface for user to interact with the system for querying using OIL language, Data repository layer – RDF to structure data repositiry and express queries over this repository, RDF query engine may be used, XML may be used to represent part of semantically annotated data, Ontology repository and QL engine

Unit5: continued…

Use cases given for the framework

Swiss Life's vision is to build an organisational memory with an intranet-based portal. A skills database contains a large variety of structured and unstructured documents like CVs, recruitment profiles, course and project descriptions. Information about an insurance product comprises documents for sales persons, for training purposes, about performing office tasks.

BT Call Centres are an increasingly important mechanism for customer contact in many industries. Every transaction should emphasize the uniqueness of both the customer and the customer service person. To do this one needs effective knowledge management. This includes knowledge about the customer but also knowledge about the customer service person, so that the customer is directed to the right person to answer their query. This knowledge must also be used in a meaningful and timely way. The On-To-Knowledge techniques provide an intuitive front-end to these heterogeneous information sources, to ensure that the performance of the best agents is transferred to the others.

Unit6:

Chapter 3 of Solanki, A (2019) An Introduction to Knowledge Engineering.

Data acquisition methods: Interview with human domain expert:

Unstructured interview: early stage interview to enable knowledge engineer to gain understanding of knowledge domain. It consists mainly of expert's free-flowing talk and some spontaneous questions from engineer. Little prior planning required. It rarely provide complete domain knowledge and time consuming

Structured interview: It is focussed on specific area, enables the expert answer clearly and detailed manner without time pressure. It is interesting for both parties to relate to the subject to transfer more information to the engineer.

Event recall interview: specifically designed to obtain procedural information. good at revealing the decision-making process itself; the sequence of thought processes. They are also very good for checking completeness of the knowledge acquisition sessions, though they have a tendency to degenerate into a general discussion has to be avoided

Thinking aloud interview: aim is to fill any gaps in knowledge following the structured interview and to validate knowledge already obtained as well as obtain information about the sequence of steps taken by an expert in solving a problem. These interviews normally discuss actual cases, although for ethical reasons these cases may be simulated rather than real. However, the process of verbalising their thoughts may distract the expert from solving the particular problem, and therefore can actually interfere with the normal thinking process.

Other less used knowledge acquisition techniques

Tutorial interviews - The expert is asked to prepare a presentation on a subject area to help the knowledge engineer become familiar with the knowledge domain.

Twenty question interviews - An interview to gather important characteristics of a part of a domain. The person being interviewed can only answer 'yes' or 'no' to questions. Either the knowledge engineer asks questions to obtain basic concepts of the domain, or the expert asks questions to check the engineer's understanding.

Trigger interviews -. the knowledge engineer issues materials within the interview that are intended to trigger and stimulate the experts' responses, and to trigger particular memories. Triggers can include structured diagrams derived from earlier knowledge acquisition sessions, and this can be useful in presenting these to experts to check the quality of the knowledge they represent. Triggers can also include archive data from past instances of problem-solving activity.

Unit 6: continued…

Teach back interviews - These involve the knowledge engineer teaching back to the expert what they think they have learned from other knowledge acquisition processes. Such an approach highlights gaps or inaccuracies in the understanding of the knowledge engineer so these can be corrected

Repertory grids a method of recording an expert's view of a particular problem. The elements of the problem are recorded across the top of the grid; these are a list of people, objects or situations familiar to the expert. The rows in the grid contain the constructs relevant to the elements, which are obtained during the elicitation process. A construct represents a bipolar characteristic that each element in the grid has.

Cons of interview: takes long time, requires planning and skills

Other important knowledge acquisition techniques include documentation analysis, questionnaires, formal techniques and observation analysis.

Unit11

Bright, T.J., Furuya, E.Y., Kuperman, G.J., Cimino, J.J. & Bakken, S. (2012) Development and evaluation of an ontology for guiding appropriate antibiotic prescribing. Journal of biomedical informatics 45(1): 120-128.

Ontology design principles used:

A six-step development process for the antimicrobial-microorganism ontology: 1. define the ontology domain and scope; 2. review existing ontologies; 3. identify classes and properties; 4. create a conceptual map; 5. identify and implement an upper ontology; and 6. implement the ontology in a formal representation.

Artefacts produced:

Rule development: Presecribing rules developed in SWRL for mathematical and string operations to enhance reasoning capabilities. Incorporated the Jess Rules engine to execute the SWRL rules and infer new knowledge about the ontology and access semantic query-enhanced web rule language

Alerts and ontology-driven alert module development: The SWRL rules were used to generate the prescribing alerts using the assertional knowledge about the relationships between the classes. Users interacted with the antibiotic prescribing alerts using the ontology-driven alert module. The alert module and associated SWRL rules were implemented in Java.

Patient database development. A patient database that included de-identified patient microbiology culture results and findings for fictitiously named individuals of the patient class in the ontology was created to evaluate the SWRL rules in generating the prescribing alerts. The patient data were manually entered in Protégé.

Method of ontology evaluation employed:

Correctness of the ontology was assessed using a set of ontology design principles and domain expert review via the laddering technique. The above three artifacts support the extrinsic evaluation and used it to evaluate the usefulness of the ontology for performing knowledge management tasks to maintain the ontology and for generating alerts to guide antibiotic prescribing.