**Jaypee Institute of Information Technology**

**Subject: TFCS**

**Tutorial-9**

**Sem-III, CSE/IT, ODD 2022**

[1]Let p and q be the propositions “Swimming at the New Jersey shore is allowed” and “Sharks have been spotted near the shore,” respectively. Express each of these compound propositions as an English sentence.

a) ¬q b) p ∧ q c) ¬p ∨ q d) p →¬q e) ¬q → p f ) ¬p →¬q g) p ↔¬q h) ¬p ∧ (p∨ ¬q)

[2] Let p, q, and r be the propositions : p : Grizzly bears have been seen in the area.

q : Hiking is safe on the trail.

r : Berries are ripe along the trail.

[2]Write these propositions using p, q, and r and logical connectives (including negations).

a) Berries are ripe along the trail, but grizzly bears have not been seen in the area.

b) Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.

c) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

d) It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the berries along the trail are ripe.

e) For hiking on the trail to be safe, it is necessary but not sufficient that berries not be ripe along the trail and for grizzly bears not to have been seen in the area.

f ) Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail.

[3] Construct a truth table for each of these compound propositions.

a) p ∧¬p

b) p ∨¬p

c) (p ∨¬q) → q

d) (p ∨ q) → (p ∧ q)

e) (p → q) ↔ (¬q →¬p)

f ) (p → q) → (q → p)

**Applications**

[4] Express these system specifications using the propositions p “The message is scanned for viruses” and q “The message was sent from an unknown system” together with logical connectives (including negations).

a) “The message is scanned for viruses whenever the message was sent from an unknown system.”

b) “The message was sent from an unknown system but it was not scanned for viruses.”

c) “It is necessary to scan the message for viruses whenever it was sent from an unknown system.”

d) “When a message is not sent from an unknown system it is not scanned for viruses.”

[5] Are these system specifications consistent? “The router can send packets to the edge system only if it supports the new address space. For the router to support the new address space it is necessary that the latest software release be installed. The router can send packets to the edge system if the latest software release is installed, The router does not support the new address space.”

[6] Translate the statements into logical expressions and reasoning from these expressions using truth tables.

A detective has interviewed four witnesses to a crime. From the stories of the witnesses the detective has concluded that if the butler is telling the truth then so is the cook; the cook and the gardener cannot both be telling the truth; the gardener and the handyman are not both lying;

and if the handyman is telling the truth then the cook is lying. For each of the four witnesses, can the detective determine whether that person is telling the truth or lying? Explain your reasoning.

**De Morgan’s Law**

[7] Show that each of these conditional statements is a tautology by using truth tables.

a) (p ∧ q) → p

b) p → (p ∨ q)

c) ￢p → (p → q)

d) (p ∧ q) → (p → q)

e) ￢(p → q) → p

f ) ￢(p → q)→￢q

**Predicates and quantifiers**

**[8]** Translate in two ways each of these statements into logical expressions using predicates, quantifiers, and logical connectives. First, let the domain consist of the students in your class and second, let it consist of all people.

a) Someone in your class can speak Hindi.

b) Everyone in your class is friendly.

c) There is a person in your class who was not born in

California.

d) A student in your class has been in a movie.

e) No student in your class has taken a course in logic

programming.

[9] **(Nested Quantifier**) Let T (x, y) mean that student x likes cuisine y, where the

domain for x consists of all students at your school and the domain for y consists of all cuisines. Express each of these statements by a simple English sentence.

a) ¬T (Abdallah Hussein, Japanese)

b) ∃xT (x, Korean) ∧ ∀xT (x, Mexican)

c) ∃y(T (Monique Arsenault, y) ∨ T (Jay Johnson, y))

d)∀x∀z∃y((x = z)→¬(T (x, y) ∧ T (z, y)))

e) ∃x∃z∀y(T (x, y) ↔ T (z,y))

f ) ∀x∀z∃y(T (x, y) ↔ T (z,y))

[10**] ( Rule of Inference**) Use rules of inference to show that the hypotheses “Aandy

works hard,” “If Aandy works hard, then he is a dull boy,” and “If Aandy is a dull boy, then he will not get the job” imply the conclusion “Aandy will not get the job.”