



COMSATS Institute of Information Technology, Islamabad Campus

Department of Computer Science

Discrete Structures – CSC102

BCS – II

Assignment #2 Marks: 35 Mapped to CLO1 & 2

Q1: a) Let p and q be the propositions Mapped to CLO1 [3+2+5+5=15]

p : It is below freezing.

q : It is snowing.

Write these propositions using p and q and logical connectives (including negations).

a) It is below freezing and snowing.

b) It is below freezing but not snowing.

c) It is not below freezing and it is not snowing.

d) It is either snowing or below freezing (or both).

e) If it is below freezing, it is also snowing.

f) Either it is below freezing or it is snowing, but it is not snowing if it is below freezing.

g) That it is below freezing is necessary and sufficient for it to be snowing.

Q1: b) Express these system specifications using the propositions and logical connectives (including negations).

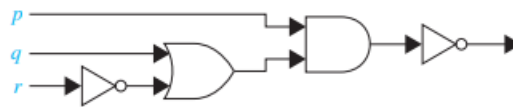
p: The user enters a valid password

q: Access is granted

r: The user has paid the subscription fee

- a) “The user has paid the subscription fee, but does not enter a valid password.”
- b) “Access is granted whenever the user has paid the subscription fee and enters a valid password.”
- c) “Access is denied if the user has not paid the subscription fee.”
- d) “If the user has not entered a valid password but has paid the subscription fee, then access is granted.”

Q2: a) Find the output of the following combinatorial circuit. (3+2)



b) Show that $\neg(p \rightarrow q) \rightarrow \neg q$ is a tautology using equivalence laws.

Q3: Let $C(x)$ be the statement “x has a cat,” let $D(x)$ be the statement “x has a dog,” and let $F(x)$ be the statement “x has a ferret.” Express each of these statements in terms of $C(x)$, $D(x)$, $F(x)$, quantifiers, and logical connectives. Let the domain consist of all students in your class.

- a) A student in your class has a cat, a dog, and a ferret.
- b) All students in your class have a cat, a dog, or a ferret.
- c) Some student in your class has a cat and a ferret, but not a dog.
- d) No student in your class has a cat, a dog, and a ferret.

- e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has this animal as a pet.

Q4: Mapped to CLO2 (Rules of Inference)

[5+5+6+4=20]

a) What rule of inference is used in each of these arguments?

- i. Alice is a mathematics major. Therefore, Alice is either a mathematics major or a computer science major.
- ii. Jerry is a mathematics major and a computer science major. Therefore, Jerry is a mathematics major.
- iii. If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed.
- iv. If it snows today, the university will close. The university is not closed today. Therefore, it did not snow today.
- v. If I go swimming, then I will stay in the sun too long. If I stay in the sun too long, then I will sunburn. Therefore, if I go swimming, then I will sunburn.

b) Show that the premises “If you send me an e-mail message, then I will finish writing the program,” “If you do not send me an e-mail message, then I will go to sleep early,” and “If I go to sleep early, then I will wake up feeling refreshed” lead to the conclusion “If I do not finish writing the program, then I will wake up feeling refreshed.”

c) For each of these sets of premises, what relevant conclusion or conclusions can be drawn? Explain the rules of inference used to obtain each conclusion from the premises.

- i. “If I play hockey, then I am sore the next day.” “I use the whirlpool if I am sore.” “I did not use the whirlpool.”

ii. “If I work, it is either sunny or partly sunny.” “I worked last Monday or I worked last Friday.” “It was not sunny on Tuesday.” “It was not partly sunny on Friday.”

iii. “All insects have six legs.” “Dragonflies are insects.” “Spiders do not have six legs.” “Spiders eat dragon flies.”

iv. “Every student has an Internet account.” “Homer does not have an Internet account.” “Maggie has an Internet account.”

v. “All foods that are healthy to eat do not taste good.” “Tofu is healthy to eat.” “You only eat what tastes good.” “You do not eat tofu.” “Cheeseburgers are not healthy to eat.”

vi. “I am either dreaming or hallucinating.” “I am not dreaming.” “If I am hallucinating, I see elephants running down the road.”

d) For each of these arguments determine whether the argument is correct or incorrect and explain why.

i. Everyone enrolled in the university has lived in a dormitory. Mia has never lived in a dormitory. Therefore, Mia is not enrolled in the university.

ii. A convertible car is fun to drive. Isaac’s car is not a convertible. Therefore, Isaac’s car is not fun to drive.

iii. Quincy likes all action movies. Quincy likes the movie Eight Men Out. Therefore, Eight Men Out is an action movie.

iv. All lobstermen set at least a dozen traps. Hamilton is a lobsterman. Therefore, Hamilton sets at least a dozen traps.