# FAST- National University of Computer & Emerging Sciences, Karachi.

## Department of Computer Science

## Assignment # 2

## Fall 2020

## CS211-Discrete Structures

**Instructions:**

**1- This is hand written assignment.**
**2- Just write the question number instead of writing the whole question. 3- You can only use A4 size paper for solving the assignment.**

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**Question: 1 what rule of inference is used in each of these arguments?**

**a) Alice is a mathematics major. Therefore, Alice is either a mathematics major or a computer science major.**
**b) Jerry is a mathematics major and a computer science major. Therefore, Jerry is a mathematics major.**
**c) If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed.**
**d) If it snows today, the university will close. The university is not closed today. Therefore, it did not snow today.**
**e) 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.**

**Question: 2 for each of these collections of premises, what relevant conclusion or conclusions can be drawn? Explain the rules of inference used to obtain each conclusion from the premises.**
**a) "If I take the day off, it either rains or snows." "I took Tuesday off or I took Thursday off." "It was sunny on Tuesday." "It did not snow on Thursday."**
**b) "If I eat spicy foods, then I have strange dreams." "I have strange dreams if there is thunder while I sleep." "I did not have strange dreams."**
**c) "I am either clever or lucky." "I am not lucky." "If I am lucky, then I will win the lottery."**
**d) "Every computer science major has a personal computer." "Ralph does not have a personal computer." "Ann has a personal computer."**
**e) "What is good for corporations is good for the United States." "What is good for the United States is good for you." "What is good for corporations is for you to buy lots of stuff."**
**f) "All rodents gnaw their food." "Mice are rodents."**

**Question: 3 Show that the argument form with premises $(p \wedge t) \rightarrow (r \vee s)$, $q \rightarrow (u \wedge t)$, $u \rightarrow p$, and $\neg s$ and conclusion $q \rightarrow r$ is valid.**

**Question: 4 For each of these arguments, explain which rules of inference are used for each step.**
**a) "Linda, a student in this class, owns a red convertible. Everyone who owns a red convertible has gotten at least one speeding ticket. Therefore someone in this class has gotten a speeding ticket."**
**b) "Each of five roommates, Melissa, Aaron, Ralph, Veneesha, and Keeshawn, has taken a course in discrete mathematics. Every student who has taken a course in discrete mathematics can take a course in algorithms. Therefore, all five roommates can take a course in algorithms next year."**
**c. "All movies produced by John Sayles are wonderful. John Sayles produced a movie about coal miners. Therefore, there is a wonderful movie about coal miners."**
**d) "There is someone in this class who has been to France. Everyone who goes to France visits the**

**Louvre. Therefore, someone in this class has visited the Louvre."**

**Question: 4 By using Laws of inference, show that the following statement is valid:**

**f) If today is Tuesday, I have a test in Mathematics or Economics. If my Economics professor is sick, I will not have a test in Economics. Today is Tuesday, and my Economics professor is sick. Therefore, I will have a test in Mathematics.**
**g)If Ali is a lawyer, then he is ambitious. If Ali is an early riser then he does not like chocolates. If Ali is ambitious then he is an early riser. Then if Ali is a lawyer then he does not like chocolates.**

**Question: 5 Prove or disprove the following expression by using the set identities:**

**a) (A − (A ⋂ B)) ⋂ (B − (A ⋂ B)) = Φ** **b) (A − B) ∪(A ⋂ B) = A**
**c) (A − B) – C = (A − C) – B**

**Question: 6 Let U= {1, 2, 3, 4, 5, 6, 7,8}, A = {1, 2, 4, 5}, B = {2, 3, 5, 6}, and C = {4, 5, 6, 7}. Find:**
**a) (A ∩ B) ∩ *C*** **b) *A*∪ (B ∪ C)** **c) (A − B) ∩ C** **d) (A ∩*B*∪ *C***
**Draw the Venn diagrams for each of these combinations of the sets *A*, *B* and *C*.**

**Question: 7 Question: 4 Let A= {a, b, c, d} and B = {a, b, c, d}. Consider the following functions:**
**a) *f(a) = b, f(b) = a, f(c) = c, f(d) = d*** **b) *f(a) = b, f(b) = b, f(c) = d, f(d) = c***
**c) *f(a) = d, f(b) = b, f(c) = c, f(d) = d*** **d) *f(a) = c, f(b) = a, f(c) =b, f(d) = d***

**Determine the Domain, Co-domain and Range of the functions.**
**Determine whether the functions are Injective, Surjective and Bijective or not?**
**Determine the inverse of function if exists.**

**Question: 8 Let *f* and g be the functions from the set of integers to the set of integers defined by *f*(a) = 2a + 3 and g(a) = 3a + 2.**
**What is the composition of *f* and g? What is the composition of g and *f*?**
**Which type of function *f* and g are?**
**Are *f* and g invertible?**

**Question: 9 suppose that g is a function from A to B and f is a function from B to C. Prove each of these statements.**
**a) If f ◦ g is onto, then f must also be onto.**
**b) If f ◦ g is one-to-one, then g must also be one-to-one.**
**c) If f ◦ g is a bijection, then g is onto if and only if f is one-to-one**

**Question: 10. Determine whether f : Z × Z → Z is onto if**
**a) f (m, n) = 2m − n.**
**b) f (m, n) = m**
**c) f (m, n) = m + n + 1.**
**d) f (m, n) = |m| − |n|.**
**e) f (m, n) = m**