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| **COMP-232**  **MATHEMATICS FOR COMPUTER SCIENCE Fall 2019**  Assignment #2  **Shadi Jiha**  **#** **40131284** |

**1. Let P(x; y; z) denote the statement \x + y B z, " where x; y; z > Z+. What is the truth value of each of the following? Explain your answers.**

True because as it says “Every added to some will be less than or equal to . Suppose that Then the statement is true because .

False, because can be then is false

True because as it says “Every added to some will be less than or equal to some . Suppose that Then the statement is true because .

**2. For each of the premise-conclusion pairs below, give a valid step-by-step argument (proof) along with the name of the inference rule used in each step. For examples, see pages 73 and 74 in textbook.**

**3. For each of the following, determine whether the argument is valid. You may use a counterexample or equivalence transformations to justify your answer.**

False if

|  |  |  |
| --- | --- | --- |
|  |  |  |
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | T |

So, it is valid

1. ((

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Now it is easy to do truth table and we see that if the result will be false. So, the argument is invalid.

|  |  |  |
| --- | --- | --- |
|  |  |  |
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | T |

So, the argument is valid.

**4. For each of the arguments below, indicate whether it is valid or invalid.**

So:

Helen eats an apple a day

Helen is healthy

Which satisfies the initial equations

So:

Herbert eats an apple a day

Helen is healthy

. It seams okay on paper. However, for this statement to be true the initial condition should be an “if and only if” as follows . Because otherwise, Herbert can be unhealthy for other reasons, not necessarily not eating applies. So, the argument isn’t valid

1. let

So, let and . If neither of those are equal to 0 then the quadratic equation cannot be satisfied and thus the argument is valid

**5. Use rules of inference to show that if are true, then is true**

**6.**

**a)** **Give a direct proof of: \If x is an odd integer and y is an even integer, then x + y is odd."**

let be an odd number so where

let be an even number so where

So, we have:

. In other words, if we can proof that then we proof that even + odd = even. Otherwise, even + odd = odd.

We can see here that is multiplied by 4 then added to 1. So, if is odd then is even and then is odd. Similarly, if is even then is even and is odd.

**b) Give a proof by contradiction of: “If n is an odd integer, then n2 is odd.”**

Let’s assume that n is even, then , where . Then so the result is a multiplier of 2 and thus the result will be even. However, if is odd, so that then

Thus, will be an even number because each is multiplied by 4 which is a multiplier of 2 and add to 1 so the total result will be odd.

**c) Give an indirect proof of: “If x is an odd integer, then x + 2 is odd."**

If is an odd integer, then we can write it as follows (where ). Thus, we have:

We can see here that is an even number because it is a multiplier of 2 and then we add it to an odd number. Thus, the result is odd because even + odd = odd as proven in a).

**d) Use a proof by cases to show that there are no solutions in positive integers to the equation .**

because if they are larger than 3 will go above 100.

So here are the combinations:

So we can see that there is no positive integer that can satisfy this equation.

**e) Prove that given a nonnegative integer n, there is a unique nonnegative integer m, such**

**that m2 B n < (m+ 1)2.**

Case 1: n is a perfect square so

Take

For example,

Case 2: n is not a perfect square so

Take

For example,

**7. For each of the statements below state whether it is True or False. If True, then give a proof. If False then explain why, e.g., by giving a counterexample.**

a) False, because which is an even number

b) False, because and they are all even numbers

c) True

let then:

So, we see that is multiplied by 2 and then added to an even number so the total result will be even

d) True, because an irrational number has an infinite number of decimals. So, when add 2 numbers with infinite number of decimals the result will also be with infinite number of decimals. Thus, it will be irrational.

e) True, because for example is irrational and when we double it is still an irrational.