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Contrapositive of a biconditional statement

Conditionality and Two-Condition Logic is a hygiene math practice to keep your ideas healthy and strong. —Hermann Weyl (1885–1955) Definitions. Given the proposals p and q, it represents a conditional proposal if p, then q. or p means q. Proposition p is called the predecessor, and proposition q is called consistency. Condition has truth table p q T T T F F F T F F F T Many people have trouble understanding the truth value for conditional. The following example will help illustrate the true value for a conditional. The person makes a promise: If I find a $20 bill, I'll take you to the movie. Now we wonder when a person broke a promise. (1) The person finds a $20 bill and takes you to the movie. is true because the person has not broken his promise. Note p and q are real. (2) The person finds a $20 bill and won't take you to the movie. is false because the person broke the promise. Note p is true, but q is false. (3) The person didn't find the $20 bill, but took you to the movie anyway. is true because the person has not broken his promise. Note p is false, but q is true. (This is a case with which many people have difficulty understanding.) (4) The person has not found the $20 bill and will not take you to the movie. is true because the person has not broken his promise. Note p and q are false. Examples of true statements. (a) If x is an odd total number, then x+1 is an even integer. (b) If f is differentiated in a and has a relative end in a, then f 'a) = 0. c) If two lines are perpendicular to the same line, then both lines are parallel. (True in neutral geometry, but false in elliptical geometry.) d) If 3 < 2, then 9 < 4. e) If 2 < 3, then 4 < 9. f) If 3 < 2, then 4 < 9. Examples of false statements. (a) If x is an odd integer, then x+2 is an even integer. b) If 2 < 3, then 9 < 4. Definitions. The opposite is true. The opposite is . Contrapositive is . Examples. Conditional: If the polygon is a square, it has four sides of equal length. conversely: If the polygon has four sides of equal length, then it is a square. Inverse: If the polygon is not a square, there are no four pages of equal length. contrapositive: If the polygon does not have four sides of equal length, it is not a square. Conditional: If f is differentiable in a and has relative limbs in a, then f' (a) = 0. conversely: If f 'a) = 0, then f is differentiable in a and has relative limbs on a. inverse: If f is not differentiable in a or no relative limb in a, then contrapositive: If then f is not differentiable in a or no relative limb in a. Conditional its contrapositive are equivalent. p q q ~q ~p T T T T F F T T F T F F F F F F F F F T T T F F F F F F F F F F F F T T T T A conditional is neither the inverse nor the opposite. Note that the conditional inverse is contrapositive reverse. Definition. p if and only if q is a two-term instruction and is marked and often written as p iff q. Two-conditions is true only if p and q have the same truth value. The truth table for two-conditions is the p q T T T F F F F F F T Note, which is equivalent to the two-conditions statements often found in mathematics. Definitions are usually two-conditions. Examples. a) A quadrilateral is a rectangle if and only if it has four straight angles. Theorem 1. For proposals p, q and r: (a) is logically equivalent (b) is logically equivalent. (DeMorgan) (DeMorgan's) c) is logically equivalent. (DeMorgan) (DeMorgan's) d) is logically equivalent. (e) is logically equivalent . (f) is logically equivalent . (g) is logically equivalent . (h) is logically equivalent . Examples. (a) It is false that transformation is isometry and transformation is dilatation. is equivalent to transformation is not isometry or transformation is not edification. (b) It's not that if John is 16, then John has a driver's license. is the equivalent of John is 16 years old and does not have a driver's license. Definitions. Conditions are often written in forms other than if-then. Necessary terms (only if) and sufficient (if) are often used when specifying conditions. The predecessor is a sufficient condition; this is a necessary condition. Examples that are equivalent to the same conditional form. For f to be isometry, it is enough that f is a rotation. If f is rotation, f is isometry. In order for f to be a revolution, it is necessary that f be isometry. f is rotation only if f is isometry. For two triangles to be a perspective from a point, it is necessary that triangles be a perspective from a line. Two triangles are a perspective from a point only if the two triangles are a perspective from a line. If the two triangles are perspectives from a point, then they are perspectives from the line. To make two triangles a perspective from a line, it is enough that the two triangles are from the perspective of the point. Page 2 of Quantifiers Mathematics is a tool specifically designed to deal with abstract concepts of all kinds and there are no limits to its power in this field. — Definition by Paul Adrien Maurice Dirac (1902–1984). An open sentence is a statement that includes one or more variables. Examples. (a) b) Owns stereo. c) It is a triangle. An open sentence is neither true nor false. Open sentence proposal only after replacing variables with specific values. We will allow P(x) to de indicate a single open sentence of variables, and P(x1, x2,..., xn) will indicate an open sentence in variables n x1, x2,..., xn. Example. P(x1, x2, x3, x4) : x3 = 5x1 – 2x2 + 3x4 Definition. A set of open-minded truths is a collection of objects from a particular universe, which makes an open sentence a real proposition. Examples. P(x) : x < 3 (i) If the universe is a set of natural numbers, the set of truth is {1, 2}. (ii) If the universe is a set of totals, then the set of truth is {..., –3, –2, –1, 0, 1, 2}. P(x) : All lines parallel to a line by a point that is not on the line. (i) In Euclidean geometry, the set of truth contains one line. (ii) In hyperbolic geometry, the set of truth contains infinitely many lines. (iii) In elliptical geometry, the set of truth is an empty set/zero set. Definition. For an open sentence, P(x) is read for all x, P(x). The sentence is true exactly when P(x) is true to all x in a particular universe, that is, the set of truth is the universe. is called a universal quantifier. Definition. For an open sentence, P(x) is the reading There is an x such that P(x). or There is . The sentence is true when the truth set for P(x) is non-empty. is called an existential quantifier. Examples. Let the universe be a set of real numbers. (a) is true; whereas it is false. [Consider x = 0.] (b) is false; whereas this is true. (c) The assumption that P(x) represents x is positive. and S(x) represents x is a square. (i) is false. [Not all actual numbers are positive.] (ii) is true. (iii) is true. (iv) is false. [Consider x = 0.] Quantifiers are often not obvious when we use English. We must be aware that a sentence can be a quantitative judgment, even if it is not given to everyone and exists. This means that we need to be vigilant about hidden quantifiers. Examples. (1) Some quadrilaterals are rectangles. means (x is quadrilateral, and x is a rectangle). (2) Some transformations are reflections and some are translations. Means. Or. Be wary of incorrect translation of a sentence in the state or as . (3) All P(x) are deassed by Q(x). All triangles have three sides. means For all x, if x is a triangle, then x has three sides. (4) Let N represent a set of natural numbers and represent a set of real numbers. (a) is a true opinion. (b) is a false opinion. (c) is a false opinion. Definition. Two quantitative sentences, having the same universe, are equivalent to having the same set of truth. Example. is equivalent to x < 4 when the universe is a set of natural numbers, but they are not equivalent when is a set of real numbers. Actual. the relationship between quantitative sentences. Theorem 2. For open sentences, A(x), (1) is equivalent; and (2) is equivalent . Proof. (1) is true iff is a false truth iff set for A(x) is not the true iff universe set for ~ A(x) is not an empty set iff is true. (2) The proof is similar. Write this evidence as an exercise.// Example. Find denial All projectivities are aspects. Statement: Negation: There is a one-to-one mapping that is projectivity and is not perspectivity or simply written as There is a projectivity that is not perspectivity. Definition. For an open sentence, P(x) is read There is a unique x such that P(x). A sentence is true when the truth set for P(x) contains exactly one element of the universe. is called a quantifier of a unique existence. Example. it is true when the universe is a natural number, but it is false if the universe is integers. An alternative equivalent form for an open sentence is this alternative form is useful when writing a denial for an open sentence that includes a unique existence quantifier. Page 3 Important arguments and constructing evidence Reductio ad absurd ... is a much finer gambit than any chess gambit: a chess player can offer a pawn or even a piece, but a mathematician offers a game. — Sir Godfrey Harold Hardy (1877-1947) The thesis (proven statements) derives from unspecified terms, defined terms, assumptions and previously proven thesis using tautology and valid arguments. A reminder from an earlier one. Tautology is a proposal that is always true. List of certain basic tautology to be used: (1) Excluded measure (2) Opposing (3) Contradiction (reductio ad absurden) (4) Associativity and (5) Distribution and (6) (7) (8) DeMorgan's Laws and (9) Transitivity (Hypothetical Syllogism) (10) Modus Ponens (11) Modus Tollens (12) Disjunctive Syllogism (13) Simplification and (14) Consistency (15) Conditional Conclusion If p and q are equivalent, it will always be tautology. Some equivalent forms that are not in the above list of tautologies: (1) p and ~(~p) (2) and (3) and (4) and (5) and (6) and i Definition. The argument consists of premises and an application. The argument is that it is important to iff whenever the premises are true, the conclusion is true. Definition of a valid argument given symbolically: the argument is valid iff is tautology. Examples. (a) Valid modus ponens argument: If is a square, that is, a rectangle. Quadrilateral ABCD is a square. Therefore, the quadrilateral ABCD is a rectangle. Symbolic form of argument (b) Valid transitive argument: If the triangle is isosceliable, the two sides of the triangle match. If the two sides of the triangle converge, the two angles of the triangle converge. Therefore, if the triangle is isoscelate, the two angles of the triangle converge. Symbolic form of argument (c) Invalid argument: Abc angle or DEF angle is open. The ABC angle is open. Therefore, the DEF angle is open. The symbolic form of an invalid definition argument. This is evidenced by a sequence of valid arguments which uses the theorca and axioms of the axiomatic system to inferre a valid conclusion. Example. Prove. We use two-column evidence to highlight the reasons for each valid argument. Proof. 1. Assumption 2. assumption 3. ~r assumption 4. steps 2 and 3 disjoint sylogism 5. ~q step 4 simplification 6. Steps 1 and 5 modus tollens Above example illustrates the use of direct proof. The following graphs illustrate the general forms of evidence that use tautology contraposition or tautology contradictions. Contraposition Proof suppose ~q (use direct proof) Therefore, ~p. Therefore, proof p by contradiction suppose ~p (use direct evidence) Therefore, q. Therefore, ~q. Thus, contradiction. Hence, p. These are called intermediate trials. Contraposition and contradictions are different tautology/argument/proof forms, but many mathematicians write some evidence in the form of contradictions when they are actually filling out evidence by contraposition. To prove that a statement is false, simply provide a counter-example. Example. We prove that the statement Rectangle is a square. is false with a counter-example. Consider a rectangle in the Euclidean plane with vertices in (0, 0), (0, 2), (2, 1) and (0, 1). The sides are 1 and 2 lengths long. Hence, it is not a square. We conclude this logic review with two-column evidence, after which we divide the evidence into its logical components arguments. Example. Given the ABC triangle with an external BCD angle. Prove bac angle and ACB angle can not be both viewing angles. Justification 1. Suppose the BAC angle and the ACB angle are both right angles. Take the refusal of the application. 2. BCD angle is the outer angle of the TRIANGLE ABC. assumption 3. The BCD angle measure is greater than the BAC angle measure. The outer angle is greater than its remote internal angles. 4. ACB angle and BCD angle are linear pair. Definition of the outside angle. 5. BCD Angle at right angles. If one angle of the linear pair of angles is at right angles, the other angle is also a right angle. 6. The measures of bac angle and BCD angle are equal. All angles at right angles have the same measure. 7. Therefore, the BAC angle and the ACB angle are not both right angles. Steps 5 and 6. Contradiction. We symbolize these proposals. a: The BAC angle is right angle. b: The ACB angle is right angle. c : The BCD angle is right angle. d : The BCD angle is the outer angle of the ABC triangle. e : The BCD angle measure is equal to the BAC angle measurement. f: The ACB angle and the BCD angle are linear pair. Consider steps 2 and 3, we have by modus ponens that . Consider steps 2 and 4, we have three arguments to come to the conclusion in step 4: (i) equivalence with the definition of external angles; (ii) simplification; and (iii) modus ponens . Consider steps 1, 4 and 5, we have two arguments to come to a conclusion in step 5: (i) simplification; and (ii) modus ponens . Consider steps 5 and 6, we have by modus ponens that . Finally, consider steps 3, 6 and 7, we have by contradictions that . .

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