UNIT 12: CAUSALITY: CAUSE AND CONDITIONS, NECESSARY AND SUFFICIENT CONDITIONS, CONSTANT CONJUNCTION

UNIT STRUCTURE

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12.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- define the meaning of 'causality'
- differentiate different philosophical views on causal relations
- explain the relation between cause and conditions
- analyse cause in terms of necessary and sufficient conditions
- explain the view of causality in terms of constant conjunction.

12.2 INTRODUCTION

'Cause' is a relative term, the co-relative of which is 'effect'. In the empirical sciences where inductive reasoning is applied causality and law

of causation play a significant role as fundamental concept and principle of their method. In our ordinary experiences we relate some processes to some other processes by a relation of causation while we do not ascribe such relation to others that we consider to be co-incidence, i.e., processes that are unrelated and independent to each other. To ascribe causal relation is thus a fundamental ability of a person to perceive, understand and discriminate the different kinds of relations between processes and events and make judgements about them and make one's actions adaptive to surroundings. Though we use the concept of cause in everyday life and scientific reasoning we do not turn to the concept of causality to analyse, clarify or define it except in the context of logic, epistemology, philosophy of science and metaphysics. It is commonly believed that task of scientist is to discover the order in the facts of nature and causal relation is the most significant order to be investigated and established. However, the analysis of the meaning of "causality" is problematic and the issue is entangled in controversial philosophical debates.

12.3 DEFINITION AND MEANING OF CAUSALITY

In our ordinary uses the term 'cause' is used in the sense of reasons why something happens. When we speak about the cause of some happenings we offer some explanation by relating it to some other occurrences which make it intelligible why it happens. The cause of any effect is totality of those things or circumstances the presence of which has made the effect happen and in absence of which it would not have had happened. In different context the term 'cause' is used to signify different qualities or characteristics. Sometimes it signifies necessary condition of effect. In some other situations it means sufficient condition. There is usage of the term to signify both necessary and sufficient conditions. On some occasion it may be neither sufficient nor necessary but a contributory condition of the effect. Logicians and philosophers from antiquity till our contemporary times focussed on this concept and tried to explain and analyse it. Let us consider some of their views.



CHECK YOUR PROGRESS

Q.1: How does causal relation guide our actions in everyday life?

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Q.2: State three different uses of the word “cause”.

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12.3.1 Aristotle’s View on Causality

Aristotle dealt with the concept of causality on his work *Physics*. Cause in Aristotle’s term means explanation of object or event. Cause explains in terms of what matter constitute something or of what parts, constituents element it is made up with; what is the form that matter is moulded into what it is; the efficiency, agency, skill or energy that bring in the changes in matter to give it form and the purpose, and aim that is ultimately realised by such changes. Accordingly there are four causes: material cause, formal cause, efficient cause, and final cause. This could be clarified with the example of the production of something like a sculptor making a statue of marble. The statue like any other thing or happening in the universe has its four kinds of causes. The marble used in making it is the material cause which has the potential to be changed into the definite shape. Formal cause is the shape that is given to the piece of marble; it is this shape which makes it what it is or transforms shapeless piece of marble into the statue of somebody. The sculptor is also a cause because he puts his skill and energy to turn the piece of marble into its desired form and without these the effect would not have come into existence. This is the efficient cause. The statue is built for the purpose of commemorating the person of whose statue it is. It is the aim or end for which the statue has come into existence. This is the

final cause of the statue. Thus, in Aristotle's account, cause explains every change in the universe teleologically, in terms of final aim or purpose to realise, for which matter is changed from indefinite to a definite form by some efficient power, agency or energy. This is rather a metaphysical explanation of the changes taking place in nature which does not find favour in logic and scientific method.

12.3.2 Fransis Bacon's Views on Causal Relation

Fransis Bacon is the earliest philosopher of the modern age to develop theories on scientific method and inductive logic in the book *Novum Organum*. According to Bacon in scientific investigation the laws that we are going to discover are the laws of connection between generating and generated nature. 'Nature' here means 'events that recur' or 'phenomenon that has many instances'. In Bacon's terminology 'generating nature' is the cause while 'generated nature' is the effect. A generating nature or cause of an event is co-present, co-absent and co-variant in degree with its corresponding generated nature or effect. Bacon assumed that all the complicated events or happening in the world are due to co-ordination of limited number of generating nature or causes. This can be discovered by analysing their co-presence, co-absence and co-variation. He developed a tabular method for this. Bacon also uses the term 'form' to denote cause, but it is not to be identified Aristotle's formal cause. Bacon's form is observable and could be found by careful examination of tables of presence, absence and co-variation.



ACTIVITY 12.1

How is the Aristotle's four kind of causes related to each other? Discuss.

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12.3.3 David Hume's View on Causality

According to David Hume, Inductive reasoning from observed instances to the unobserved is based on causal relation. The idea or notion of causation is a complex notion about the relation between events. Hume analysed this notion into precedence, contiguity and production or necessity. The relation of precedence and contiguity could be justified. However, the relation called production and necessary connection cannot be justified by any evidence. For Hume our inferences based on causal relation does not rest on any logical ground to ensure certainty. There is no rational ground to suppose that if instances of one kind of event have been followed by instances of another but same kind of subsequent event, it will be followed by the same kind of subsequent events in any future instance. Causal reasoning is based on our psychological propensity. Causality is nothing but mode of human behaviour to expect the same sort of consequent event to follow the same sort of antecedent event. Immanuel Kant accepts Hume's contention that there is no empirical evidence in favour of necessity or production, yet justifies such relation on grounds other than empirical. According to Kant, inductive reasoning on which sciences are based depends on causal relation. Certainty in natural sciences depends on discovery of causal relation by virtue of the necessary connection between cause and effect. The necessity of causal relation is justified by its a priori demonstration.

12.3.4 John Stuart Mill's Analysis of Causality

Now, without entering into the contested metaphysical and epistemological positions regarding the nature of causality, let us try to understand the notion of causality as analysed by some of the Inductive Logicians of modern age. John Stuart Mill tried to analyse the concept of cause in order to formulate the canons for the methods to discover causal relations amongst events. In his book 'A System

of Logic' Mill elaborates the Law of Causation and the concept of Causality. He explains causality in terms of relations between physical phenomena and keeps any metaphysical notion of causality aside from considerations. For him, the relation of succession among events is most significant and there is one law which sustains the uniformity of succession indefeasibly. This is the Law of Causation which, according to Mill, holds in the entire sphere of human experience of successive events.

Let us consider the characteristics of Cause as defined by Mill. Mill's characterisation of cause is derived from David Hume's analysis of causality and Mill's method of proof or discovery of causal relation is developed from tabular methods of scientific discovery of Francis Bacon. Mill accepts Hume's contention that cause is the invariable antecedent of the effect. Mill disagrees with Hume's rejection of necessary connection between cause and effect.

According to Mill's characterisation, causal relation holds between **successive** events. Cause is the **earlier event** or **antecedent** in time while effect is the **later or consequent**. If C is the cause of E, then E cannot be prior to or simultaneous with C. This order is irreversible provided that cause changes into effect at a speed slower than that of light; otherwise an observer may perceive effect earlier than the cause. Modern theories in physics about the structure of the universe permit cause from the future producing effect in the past. From our ordinary way of thinking it appears to be strange and paradoxical.

The succession of events may be either variable or invariable. The cause of any event is the **invariable** antecedent of the effect. Whatever earlier event is variable is not related to the latter by causal relation. To be precise, if C is the cause of E, then for every x, if x is an instance of E, x is preceded by any y, y is an instance of C.

Further, cause is the **unconditional** antecedent of the effect. If D is followed by F depending on some condition K, then D is not invariable antecedent because in absence of the condition K being

fulfilled it will not be followed by D. Thus, if C is the cause of E, then for every x, if x is an instance of E, x is preceded by any y, y is an instance of C and it is not the case that for all z, x is preceded by z and z is not part of y and there is an y not accompanied by z is not followed by an x. Thus,

C is cause of E ≡ (x)(y)(z){x ε E ≡ (x is preceded by y and y ε C) and (x is not preceded by z, z is not part of y and, y being not accompanied by z is not followed by x)}

To ascertain the unconditional character of the invariable antecedent is the most worth conducting exercise for the scientist in his investigation. The cause is the unconditional prior happening because it is inclusive of all the conditions that have to be invariably present in order that effect comes into existence. Apart from the cause there is no other condition to be fulfilled in order that the effect occurs.

Cause is also the immediate antecedent of the effect. Immediacy is implied by unconditionality. If some invariable antecedents fail to bring about the effect immediately but after some duration of time bring in the effect, then obviously during the time of interval some other required conditions have been fulfilled, i.e. some changes in the circumstances have taken place which had made the situation adequate to bring in the effect.

Cause and effect can be characterised quantitatively. The law of conservation of matter and energy implies that the quantity of matter and energy in the cause is equivalent to the quantity of matter and energy in the effect. The quantity of matter and energy in the universe is always the same but they change from one form to another. Matter and energy are never created nor destroyed. Therefore, Carveth Read stated: “The Cause of any event, then, when exactly ascertainable, has five marks: it is (quantitatively) equal to the effect, and is (qualitatively) its immediate, unconditional, invariable antecedent.”



CHECK YOUR PROGRESS

Q.3: According to Hume, to what simpler notions, the complex notion of causality can be analysed?

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Q.4: Is empirical justification of necessary connection possible?

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Q.5: What is the quantitative relation between cause and effect?

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ACTIVITY 12.2

How does Hume analyse the notion of causality?

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12.4 CAUSE AND CONDITION

Usually the cause of any phenomenon is not a single event or circumstance precedent to it but a complex of quite a number of factors. It is the coming together of all of a number of antecedents that is followed invariably by the consequent. All such antecedents are required in order that the effect follows. Each of such indispensable factors of the cause is regarded to be a condition. Conditions are either positive or negative. Positive conditions are the presence of the events or state of affairs required for the effect to occur. A negative condition is the absence of those antecedent states of affair the presence of which prevents the effect's coming into existence.

Carveth Read defines condition as 'any necessary factor of a cause' and 'a positive condition is one that cannot be omitted without frustrating the effect; and a negative condition is one that cannot be introduced without frustrating the effect'. This definition of condition involves contradiction. How can a necessary factor of cause frustrate the effect?

In our ordinary or commonsense discourse about causality we sometime select one antecedent factor which is perspicuous and strikes our attention and state this to be the cause while overlooking many other conditions which are also indispensable for the effect to occur but not so perspicuous to our observations. To quote Mill, "The cause, then, philosophically speaking, is the sum total of the conditions, positive and negative taken together; the whole of the contingencies of every description, which being realized, the consequent invariably follows". Some of the conditions are sometimes regarded to be agent while others to be patients. The agent acts upon the patient. This distinction is only verbal because on analysis both the patient and agent turn out to be active.



CHECK YOUR PROGRESS

Q.6: Define condition.

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Q.7: Differentiate between positive and negative conditions.

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12.5 NECESSARY AND SUFFICIENT CONDITION

The necessary condition of an effect is that condition in absence of which effect doesn't occur. A necessary condition *must be present* in order that the effect comes into existence. Its precedence is absolutely required for the effect. If the effect is present then its necessary conditions must have been present earlier. It can never be the case that the effect has occurred but any of its necessary condition was not fulfilled before. But the presence of any necessary condition does not guarantee that effect must follow. If some necessary conditions are present while some others are absent, then effect will not emerge. However if all the necessary conditions are fulfilled then effect is bound to take shape.

Sufficient condition means that condition (or a set of conditions) the presence of which is bound to produce the effect. It suffices to produce the effect. Whatever suffices to produce the effect will inevitably give rise to the effect. With sufficient condition being present, nothing can prevent the occurrence of the effect. Thus, effect must necessarily follow if its sufficient condition has been fulfilled. There can be many sufficient conditions each of which on its own produce the effect. However, if the effect has come into existence, it is not required that there must be some specific or definite sufficient condition out of many (each of which severally or independently sufficient) conditions has been fulfilled.

A necessary condition may not be sufficient to bring about the effect. Suppose I have switched on the fan and the fan is running. Uninterrupted supply of power from the Power Distribution Company is a necessary condition to keep the fan running but it is not sufficient because uninterrupted supply of power will not keep it moving if there is some snag in the circuit. Similarly, a sufficient condition is not necessary, e.g., my switching off is sufficient to stop the fan but not necessary because if power supply stops then too it will stop without switching it off.

If we put together all the necessary conditions, i.e., without leaving out anything necessary, then it appears to be sufficient because if all the necessary conditions are fulfilled then effect must follow. Thus all the necessary conditions put together is equivalent to sufficient condition. However, any sufficient condition is not necessary for the effect. Thus it appears to be paradoxical that the collection of all necessary conditions is not a necessary condition of the effect. This paradox can be resolved if we consider necessary conditions to be relative to some sufficient condition. There are different sets of necessary conditions each of which is sufficient to produce the effect while none of the sets is necessary for it.

According to J L Mackie, causes are insufficient but non-redundant condition of unnecessary but sufficient condition of the effect. This is known as the INUS condition of causality. For example in an incident of devastating house-fire, a fallen lamp is regarded to be the cause. Falling lamp is not the sufficient condition because in absence of combustible material and oxygen

it could not have caused the fire, neither it is a necessary condition because house-fire may occur without falling of the lamp. It is necessary condition of a sufficient condition because the accumulated combustible objects and oxygen are not sufficient to cause the fire without the fall of the lamp. This sufficient condition constituted by the falling-lamp, combustible things and oxygen is also not necessary for the house-fire because house-fire may occur in absence of all these, e.g., from arson, electrical short-circuit, explosion etc.

Many of the arguments in inductive logic depend on the causal relation. Such argument may be either from cause to effect or from effect to cause. For example, from cloud in the sky we infer imminent rain or from rising water level in the river we understand that it rained upstream in the river basin.

Arguments based on causal relation are sometimes aimed at finding necessary conditions and at others the sufficient ones. If we are interested in the problem of finding out the ways of producing the effect, then we want to formulate at least one of its sufficient conditions. On the other hand if we want to prevent the effect, we try to determine any one of its necessary conditions, the removal of which will frustrate its occurrence. A physician is interested in finding out the germs that creates a disease in order to administer effective drug to kill the germs so that the patient got cured. Presence of the germ is a necessary condition of the disease (though not sufficient) and elimination of this necessary condition removes the effect, i.e., the disease.



CHECK YOUR PROGRESS

Q.8: In absence of necessary condition can effect occur?

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Q.9: The presence of C is necessarily followed by E. Is C sufficient condition of E?

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ACTIVITY 12.3

a) When is the search for necessary condition required?

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b) For what practical purpose search for sufficient condition becomes useful?

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12.6 CONSTANT CONJUNCTION

According to David Hume, the relation between cause and effect has only the characteristics of succession and contiguity. The third characteristic of necessary connection and production is ordinarily supposed to be another essential aspect of causality. However, according to Hume, this supposition when examined proves to be incapable of any rational justification. If we analyse two similar classes of events one designated to be the cause of the other what do we find in their relation? According to Hume, when we search our experiences, i.e., sense impressions relating events called and effect we find three things in them:

1) **Relation of Succession**: The class of events called cause is experienced to be followed by the class of the events called effect. For instance, fire causes heat and smoke. Cases of fire are followed by cases of heat and smoke. Thus, causes are antecedent events and effects are consequent events. This is supported by evidence as we have impressions of fire followed by impressions of heat and smoke. But of any two classes of events the instances of one of which are followed by instances of the other is not regarded to be the cause.

2) **Relation of Contiguity:** Instances of two kinds of events related by causal relation are experienced to be contiguous. Cause is prior to effect while effect is posterior in temporal relation as experience shows us. A prior event in the remote past is not regarded to be the cause of some other event happening now. Cause and effects are experienced as antecedent to be immediately followed by the consequent. If fire is experienced the moment before, smoke and heat are to be experienced in the next moment. It is not the case that fire is experienced now and heat and smoke will be experienced tomorrow.

3) **Constant Conjunction:** It is ordinarily believed that cause and effect are not a simple relation in which events of one kind are followed by events of another. If one instance of a definite kind is experienced to be followed by another instance of some other definite kind and even if it is experienced to be so on many occasions, the relation between two kinds of events may be of co-incidence but not of causation. Therefore, it is believed that what is peculiar to causal connection is a necessary connection. Cause must produce the effect. What does this characterisation of production or necessitation mean? Hume tried to analyse the meaning of necessary connection or production or effectuation and searched for the ground of such sort of relation.

Hume considers whether this necessary causal connection could be a logical relation known *a priori*. He does not accept any *a priori* demonstration to the effect that causality is a necessary connection. We can think of the antecedent event being followed by the consequent event without having any relation between the two. We experience that the two are distinct one being followed by the other and we don't perceive any other element called connection. It involves no contradiction to think that instances of fire being followed by instances of smoke without there being any connection between the two.

If the necessity of causal relation is a logical relation then it will involve contradiction to think of any two classes of events supposed to be having a

causal relation that the antecedent event occurs but the consequent does not follow. But it does not involve any contradiction to think in this manner in any case of causal relation. For example, we may imagine without any contradiction that fire occurs but no heat generated from it.

Thus, the necessary connection which is supposed to be required in addition to succession and contiguity for a causal relation ultimately turns out to be a relation of constant conjunction. Thus, in our experience, if a large number instances of events of one and same kind are immediately followed by events of another kind, we expect the consequent events whenever we experience the antecedent event. For example, all our past experiences of fire are followed by instances of smoke. Therefore, we believe that any future instance of fire will be followed by smoke. Or fire and smoke are necessarily connected.

How does constant conjunction lead to causal relation? Constant conjunction leads to causal relation by virtue of psychological laws of association. We are determined by our natural propensity to attribute causal relation to events that are constantly conjoined in our experience. The justification of an inductive reasoning that establishes causal relation between premises and conclusion does not depend on the relation between premises and conclusion but it depends on the psychological laws of association which connect constantly conjoined experiences with a causal link. We read causality in natural events because of our nature; apart from these laws of association causality is not in the things and events themselves.



ACTIVITY 12.4

a) Can any necessary connection between cause and effect be rationally justified? Discuss after Hume.

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b) What is the role of psychological laws of human nature in producing beliefs in causal relation? Explain after Hume.

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12.7 LET US SUM UP

- 'Cause' is a relative term the co-relative of which is 'effect'. In the empirical sciences where inductive reasoning is applied causality and law of causation play a significant role as fundamental concepts and principles of their method.
- The cause of any effect is totality of those things or circumstances the presence of which has made the effect happen and in absence of which it would not have had happened. In different context the term 'cause' is used to signify different qualities or characteristics. Sometimes it signifies necessary condition of effect. In some other situation it means sufficient condition. There is usage of the term to signify both necessary and sufficient conditions. On some occasion it may be neither sufficient nor necessary but a contributory condition of the effect.
- Cause in Aristotle's term means explanation of object or event. Cause explains in terms of what matter constitutes something or of what parts, constituents element it is made up with; what is the form that matter is moulded into what it is; the efficiency, agency, skill or energy that bring in the changes in matter to give it form and the purpose and aim that ultimately realised by such changes. Thus there are four kinds of causes to explain everything– material, formal, efficient and final cause.
- According to Bacon a generating nature or cause of an event is co-present, co-absent and co-variant in degree with its corresponding generated nature or effect. Bacon assumed that all the complicated events or happening in the world are due to co-ordination of limited

number of generating nature or causes. This can be discovered by analysing their co-presence, co-absence and co-variation. He developed tabular method for this.

- According to David Hume, Inductive reasoning from observed instances to the unobserved is based on causal relation. The idea or notion of causation is a complex notion about the relation between events. Hume analysed this notion into precedence, contiguity and production or necessity. The relation of precedence and contiguity could be justified. However, the relation called production and necessary connection cannot be justified by any evidence.
- According to Mill, cause is the invariable unconditional immediate antecedent of the effect. Quantitatively matter and energy in the cause are equivalent to matter and energy in the effect.
- An indispensable factor of the cause is regarded to be a condition. Conditions are either positive or negative. Positive conditions are the presence of the events or state of affairs required for the effect to occur. A negative condition is the absence of those antecedent states of affair the presence of which prevents the effect's coming into existence.
- The necessary condition of an effect is that condition in absence of which effect doesn't occur. A necessary condition *must be present* in order that the effect comes into existence.
- Sufficient condition means that condition (or a set of conditions) the presence of which is bound to produce the effect. It suffices to produce the effect.
- According to J. L. Mackie, causes are insufficient but non-redundant condition of unnecessary but sufficient condition of the effect. This is known as the INUS condition of causality.
- According to Hume, the justification of an inductive reasoning that establishes causal relation between premises and conclusion does not depend on the relation between premises and conclusion but it depends on the psychological laws of association which connect constantly conjoined experiences with a causal link. We read causality

in natural happening because of our nature; apart from these laws of association causality is not in the things and events themselves.



12.8 FURTHER READING

1) Hume, David (1988); *A Treatise of Human Nature,* Edited by L. A. Selby Bigge; UK: Oxford University Press.
2) Mill, John Stuart (1843); *System of Logic, Ratiocinative and Inductive: Being a Connected View of the Principles and Methods of Scientific Investigation*, Volume I; London, UK: John W Parker.
3) Read, C. (1914); *Logic: Deductive and Inductive*; London, UK: Kent & Co. Ltd.



12.9 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: We guide our actions by expectations and predictions of what has already been experienced to follow an antecedent event.

Ans. to Q. No. 2: Different senses of cause are– reason why something happens, necessary conditions and sufficient conditions.

Ans. to Q. No. 3: Contiguity, succession and constant conjunction.

Ans. to Q. No. 4: No

Ans. to Q. No. 5: Equivalence.

Ans. to Q. No. 6: Condition is any necessary or sufficient factor of a cause.

Ans. to Q. No. 7: Positive condition is the presence of the circumstances that facilitates the effect. Negative condition is the absence of preventing circumstances.

Ans. to Q. No. 8: No

Ans. to Q. No. 9: Yes



12.10 MODEL QUESTIONS

A) Very Short Questions:

Q.1: Are all regularly successive pairs of events linked by causation?

Q.2: What is the co-relative term of cause?

Q.3: Is Aristotle's causal theory teleological?

Q.4: What does the term generating nature signify Bacon's writings?

Q.5: According to Hume, can necessary connection be justified by empirical evidence?

Q.6: Who propounded the INUS condition of causality?

B) Short questions (Answer each question in about 100-150 words)

Q.1: What does causality mean?

Q.2: What is material cause?

Q.3: How does Bacon explain causal relation?

Q.4: How does Hume analyse causality?

Q.5: Differentiate between cause and condition.

Q.6: Distinguish between necessary and sufficient condition.

Q.7: Explain the INUS condition of causality.

Q.8: Does constant conjunction imply necessity?

C) Short Notes: (Answer each question in about 100-150 words)

Q.1: Cause and conditions

Q.2: Necessary and sufficient condition

Q.3: INUS condition of causality

Q.4: Aristotle's theory of Cause

D) Long Questions: (Answer each question in about 300-500 words)

Q.1: Explain J. S. Mill's definition of causality.

Q.2: What does Aristotle mean by causation? Explain the four kinds of causes.

Q.3: How does Hume analyse the notion of causality? What is his psychological explanation of causal relation.

Q.4: Explain causality in terms of necessary and sufficient conditions.

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