**RES-650-Research Methods**

**Answer of the question n. 1**

**Different stages of problem formulation:**

Three Steps of the Problem Formulation Process with Some Iterations among the Find, Investigate, and Define Stages. The ability to formulate problems is an important part of computational thinking (CT) development for nurturing creative problem solvers.

The steps include: 1) identifying and categorizing problems, 2) selecting problems, 3) defining the problem, 4) analyzing the problem, 5) identifying causes, 6) finding root causes, 7) data analysis, 8) developing solutions, 9) foreseeing resistance, 10) trial implementation, 11) regular implementation, and 12) following.

Overall, the Six Step method is a simple and reliable way to solve a problem. Using a creative, analytical approach to problem solving is an intuitive and reliable process. It helps keep groups on track, and enables a thorough investigation of the problem and solution search.

The problem solving process can be divided in different. ways and the stages have been given various labels. This has been done to make it easier to understand but how it is divided and the labels that are used are not important. To be a successful problem solver need to understand what the stages involve and follow them methodically whenever encounter a problem.

Problem solving is the act of defining a problem; determining the cause of the problem; identifying, prioritizing, and selecting alternatives for a solution; and implementing a solution.

Problem Solving technique is a simple process to follow to solve any problem by repeatedly asking the question “Why” (five times is a good rule of thumb), to peel away the layers of symptoms that can lead to the root cause of a problem. This strategy relates to the principle of systematic problem solving.

There are several steps involved in a research process that help individuals associated with a study conduct successful testing. Defining a research problem is an important step in any research process and can help outline the process of study. There are several types of research problems may encounter, and understanding how they differ may help decide which approach is best.

A research problem is a statement that addresses a gap in knowledge, a challenge or a contradiction in a particular field. Scientists use research problems to identify and define the aim of their study and analysis. May decide to conduct research based on a problem if interested in contributing to social or scientific change or supplying additional knowledge to an existing topic. A research problem may also help identify key concepts and terms, overarching questions and variables associated with a study.

Implementing solution is the culmination of all efforts and requires very careful planning. The plan describes the sequence of actions required to achieve the objective, the timescale and the resources required at each stage. Ways of minimising the risks involved and preventing mistakes have to be devised and built into the plan. Details of what must be done if things go wrong are also included.

Once the plan has been put into effect, the situation has to be monitored to ensure that things are running smoothly. Any problems or potential problems have to be dealt with quickly. When the action is completed it's necessary to measure its success, both to estimate its usefulness for solving future problems of this type and to ensure that the problem has been solved. If not, further action may be required.

These stages provide a very flexible framework which can be adapted to suit all problems. With closed problems, for example, where there is likely to be only one or a few solutions, the emphasis will be on defining and analysing the problem to indicate possible causes. Open-ended problems, on the other hand, require more work at the idea generation stage to develop a large range of possible solutions.

At any stage in solving a problem it may be necessary to go back and adapt work done at an earlier stage. A variety of techniques and strategies are available to help at each stage and these are described in later articles.

Problem solving is easy, but difficult! It basically depends upon the mindset have. If can flex problem solvingnerves, then can resolve any issue. Just need to train and put in some decent effort. If following the steps of the process mentioned in this article, problem solving will become an easy job for anyone.

Focusing on end goal and strive to achieve it. This should be enough to help resolve any issues face. Need to positive, active, and productive. Over time, not only will master the skill of problem solving, but will also become better as a person.

**Answer of the question n. 2**

**Research hypothesis:**

A [theory](https://www.merriam-webster.com/dictionary/theory), in contrast, is a principle that has been formed as an attempt to explain things that have already been substantiated by data. It is used in the names of a number of principles accepted in the scientific community, such as the Big Bang Theory. Because of the rigors of experimentation and control, it is understood to be more likely to be true than a hypothesis is.

Research hypothesis is a statement that introduces a research question and proposes an expected result. It is an integral part of the scientific method that forms the basis of scientific experiments.

In the scientific method, the hypothesis is constructed before any applicable research has been done, apart from a basic background review. You ask a question, read up on what has been studied before, and then form a hypothesis.

A hypothesis is usually tentative; it's an assumption or suggestion made strictly for the objective of being tested.

A research hypothesis is a statement that brings up a question and predicts what might happen. It's really important in the scientific method and is used in experiments to figure things out. Essentially, it's an educated guess about how things are connected in the research.

In non-scientific use, however, *hypothesis* and *theory* are often used interchangeably to mean simply an idea, speculation, or hunch, with *theory* being the more common choice.

Since this casual use does away with the distinctions upheld by the scientific community, hypothesis and theory are prone to being wrongly interpreted even when they are encountered in scientific contexts—or at least, contexts that allude to scientific study without making the critical distinction that scientists employ when weighing hypotheses and theories.

The most common occurrence is when *theory* is interpreted—and sometimes even gleefully seized upon—to mean something having less truth value than other scientific principles. (The word [*law*](https://www.merriam-webster.com/dictionary/law) applies to principles so firmly established that they are almost never questioned, such as the law of gravity.)

This mistake is one of projection: since we use theory in general to mean something lightly speculated, then it's implied that scientists must be talking about the same level of uncertainty when they use theory to refer to their well-tested and reasoned principles.

The distinction has come to the forefront particularly on occasions when the content of science curricula in schools has been challenged—notably, when a school board in Georgia put stickers on textbooks stating that evolution was "a theory, not a fact, regarding the origin of living things." As [Kenneth R. Miller, a cell biologist at Brown University, has said](https://www.nytimes.com/2016/04/09/science/in-science-its-never-just-a-theory.html?_r=0), a theory "doesn’t mean a hunch or a guess. A theory is a system of explanations that ties together a whole bunch of facts. It not only explains those facts, but predicts what you ought to find from other observations and experiments.”

While theories are never completely infallible, they form the basis of scientific reasoning because, as Miller said "to the best of our ability, we’ve tested them, and they’ve held up."

A hypothesis is an assumption, an idea that is proposed for the sake of argument so that it can be tested to see if it might be true. In the scientific method, the hypothesis is constructed before any applicable research has been done, apart from a basic background review.

It is simply a proposition that is assumed to be true. It is a presumption. It is generally formulated by logical deductions of existing theories. It may also be the outcome of some empirical generalisations.

A research hypothesis (also called a scientific hypothesis) is a statement about the expected outcome of a study (for example, a dissertation or thesis). To constitute a quality hypothesis, the statement needs to have three attributes – specificity, clarity and testability.

A good research hypothesis needs to be **extremely clear and articulate** about both **what’**s being assessed (who or what [variables are involved](https://gradcoach.com/indepedent-dependent-variables/)) and the **expected outcome** (for example, a difference between groups, a relationship between variables, etc.).

**The methods of formulating hypothesis:**

To formulate a hypothesis, a researcher must consider the requirements of a strong hypothesis: Make a prediction based on previous observations or research. Define objective independent and dependent variables. Make sure the hypothesis is testable and falsifiable.

A good hypothesis needs to include operationalized variables that can be measured. It also must be testable and potentially falsifiable. For example: if the temperature of a chamber is raised, then the time it takes to melt an ice block will decrease.

In this example, the independent variable is the temperature and the dependent variable is melting time. They are both objective and measurable. The hypothesis is testable by carrying out the activity and gathering data that may support or refute the statement.

There are three types of hypothesis tests: right-tailed, left-tailed, and two-tailed. When the null and alternative hypotheses are stated, it is observed that the null hypothesis is a neutral statement against which the alternative hypothesis is tested.

The scientific method is to form a hypothesis. A hypothesis is a possible explanation for a set of observations or an answer to a scientific question. A hypothesis must be testable and measurable.

John Stuart Mill proposed three methods of hypothesis formulation in disease etiology: the Method of Agreement, the Method of Difference, and the Method of Concomitant Variation.

To formulate a hypothesis, a researcher must consider the requirements of a strong hypothesis: Make a prediction based on previous observations or research. Define objective independent and dependent variables. It should making sure the hypothesis is testable and falsifiable.

There are different types of hypotheses: Null hypothesis, Alternative hypothesis (this is also known as the non-directional, two-tailed hypothesis), and Directional hypothesis (this is also known as the one-tailed hypothesis).

First, the absence of knowledge of a theoretical framework is a major difficulty in formulating a good research hypothesis. Second, if detailed theoretical evidences are not available or if the investigator is not aware of the availability of those theoretical evidences, a research hypothesis cannot be formulated.

The formulation of a hypothesis in research is when the researcher formulates a predictive statement of what is expected to happen when testing the research question based on background research.

Hypothesis Daily exposure to the sun leads to increased levels of happiness. In this example, the independent variable is exposure to the sun – the assumed cause. The dependent variable is the level of happiness – the assumed effect.

Different methods for formulating hypotheses in research include the use of the FINER criteria and the PICO process . The FINER criteria, which stands for feasible, interesting, novel, ethical, and relevant, can help ensure that the research question is valid and will generate new knowledge with clinical impact . The PICO format, which stands for population, intervention, comparison, and outcome, helps structure the research question and narrow the focus from a broad topic .

Another method is the use of graphic communication tools, such as diagrams, to formulate hypotheses graphically . This method involves using notation, statement, and diagram languages to represent hypotheses and select appropriate diagram types based on the related variables . Additionally, hypotheses can be formulated based on assumptions about the phenomenon, problem, and subject of research, expressed as attitudes and judgments with cognitive value.

**Answer of the question n. 3**

**Various types of survey:**

Surveys can be divided into two broad categories: the [questionnaire](https://conjointly.com/kb/constructing-survey/) and the [interview](https://conjointly.com/kb/conducting-research-interviews/). Questionnaires are usually paper-and-pencil instruments that the respondent completes. Interviews are completed by the interviewer based on the respondent says. Sometimes, it’s hard to tell the difference between a questionnaire and an interview.

For instance, some people think that questionnaires always ask short closed-ended questions while interviews always ask broad open-ended ones. But you will see questionnaires with open-ended questions (although they do tend to be shorter than in interviews) and there will often be a series of closed-ended questions asked in an interview.

Survey research has changed dramatically in the last ten years. We have automated telephone surveys that use random dialing methods. There are computerized kiosks in public places that allows people to ask for input. A whole new variation of group interview has evolved as focus group methodology. Increasingly, survey research is tightly integrated with the delivery of service.

Almost everyone is familiar with the **telephone interview.** Telephone interviews enable a researcher to gather information rapidly. Most of the major public opinion polls that are reported were based on telephone interviews. Like personal interviews, they allow for some personal contact between the interviewer and the respondent.

And, they allow the interviewer to ask follow-up questions. But they also have some major disadvantages. Many people don’t have publicly-listed telephone numbers. Some don’t have telephones. People often don’t like the intrusion of a call to their homes. And, telephone interviews have to be relatively short or people will feel imposed upon.

In the case of agricultural engineering, there are eight types of levelling as “different levelling”, “check levelling”, “profile levelling”, “cross-sectioning”, “reciprocal levelling”, “barometric levelling”, “hypsometry”, and “trigonometric levelling”. This levelling is considered the operational method of levelling.

In cross-sectional design the survey takes place at one point in time giving a snapshot of the participant responses. In longitudinal design the survey is repeated two or more times within a specified period in order to detect changes in participant responses over time.

Psychologist Stanley Stevens developed the four common scales of measurement: nominal, ordinal, interval and ratio. Each scale of measurement has properties that determine how to properly analyse the data. The properties evaluated are identity, magnitude, equal intervals and a minimum value of zero.

Basic control points are set up with various types of stakes or marks on the ground and surveyed as the bases for all kinds of surveying works to achieve diverse human cultural developments. Generally, they are classified into three orders named First Order, Second Order, and Third Order.

The five common types of survey measurements are horizontal distances and angles, vertical distances and angles, and slope distances. Angles and distances are measured relative to either a horizontal or vertical plane.

Survey methods are grouped into two major categories: quantitative and qualitative. Quantitative data is objective and numbers-based, such as how many customers rated product line five out of five stars. Qualitative data is interpretation-based, and often is subjective, language-related content.

**Answer of the question n. 4**

**Type l and Type ll Error:**

A type I Error is rejecting the null hypothesis when H0 is actually true. A type II Error is failing to reject the null hypothesis when the alternative is actually true (H0 is false). We use the symbols α = P(Type I Error) and β = P(Type II Error).

A type I error (false-positive) occurs if an investigator rejects a null hypothesis that is actually true in the population; a type II error (false-negative) occurs if the investigator fails to reject a null hypothesis that is actually false in the population.

A type II error is a statistical term used within the context of hypothesis testing that describes the error that occurs when one fails to reject a null hypothesis that is actually false. A type II error produces a false negative, also known as an error of omission.

A type I error (false-positive) occurs if an investigator rejects a null hypothesis that is actually true in the population; a type II error (false-negative) occurs if the investigator fails to reject a null hypothesis that is actually false in the population.

In case of type I or type-1 error, the null hypothesis is rejected though it is true whereas type II or type-2 error, the null hypothesis is not rejected even when the alternative hypothesis is true. Both the error type-i and type-ii are also known as “false negative”.

In general, Type II errors are more serious than Type I errors; seeing an effect when there isn't one (e.g., believing an ineffectual drug works) is worse than missing an effect (e.g., an effective drug fails a clinical trial). But this is not always the case.

A Type I error occurs when a true null hypothesis is incorrectly rejected (false positive). A Type II error happens when a false null hypothesis isn't rejected (false negative). The former implies acting on a false alarm, while the latter means missing a genuine effect.

The court declares a defendant as innocent, and they're innocent. False positive (type I error): The court finds the defendant guilty but they're innocent. False negative (type II error): The court finds the defendant innocent in court, but they're guilty.

Basically, the Type I error occurs when the null hypothesis is true and ML model rejects it (false positive). The Type II error occurs when the null hypothesis is false and it does not reject it (false negative). Therefore, the ``risks'' of these two errors are inversely related.

Type – 1 error is known as false positive, i.e., when we reject the correct null hypothesis, whereas type -2 error is also known as a false negative, i.e., when we fail to reject the false null hypothesis. In this article, we will discuss difference between type 1 and type 2 error.

Researcher/scientist assumes to prove or disprove their finding. These assumptions are also known as hypotheses. There are mainly two types of hypotheses [Null and Alternative Hypothesis](https://www.shiksha.com/online-courses/articles/null-hypothesis-and-alternative-hypothesis/). Null and Alternative hypotheses are mutually exclusive statements.

A null hypothesis statement is that there is no relation between the two variables. In contrast, an alternative hypothesis is a statement that refers to the statistical relationship between the two variables.

While doing hypothesis testing, we encounter two types of errors, i.e., type-1 and type-2 errors. This article will discuss the difference between type- 1 and type-2 errors.
Type-1 and Type -2 errors are interconnected; reducing one can increase the probability of another. Type – 1 error is a false-positive finding, while type-2 error is a false-negative finding in hypothesis testing.

**Type I and Type II errors** are subjected to the result of the null hypothesis. In case of type I or type-1 error, the null hypothesis is rejected though it is true whereas type II or type-2 error, the null hypothesis is not rejected even when the alternative hypothesis is true. Both the error type-i and type-ii are also known as “**false negative**”. A lot of statistical theory rotates around the reduction of one or both of these errors, still, the total elimination of both is explained as a statistical impossibility.

A type I error appears when the [null hypothesis](https://byjus.com/maths/null-hypothesis/) (H0) of an experiment is true, but still, it is rejected. It is stating something which is not present or a false hit. A type I error is often called a false positive (an event that shows that a given condition is present when it is absent). In words of community tales, a person may see the bear when there is none (raising a false alarm) where the null hypothesis (H0) contains the statement: “There is no bear”.

The type I error significance level or rate level is the probability of refusing the null hypothesis given that it is true. It is represented by Greek letter α (alpha) and is also known as alpha level. Usually, the significance level or the probability of type i error is set to 0.05 (5%), assuming that it is satisfactory to have a 5% probability of inaccurately rejecting the null hypothesis.

A type II error appears when the null hypothesis is false but mistakenly fails to be refused. It is losing to state what is present and a miss. A type II error is also known as false negative (where a real hit was rejected by the test and is observed as a miss), in an experiment checking for a condition with a final outcome of true or false.

A type II error is assigned when a true [alternative hypothesis](https://byjus.com/maths/alternative-hypothesis/) is not acknowledged. In other words, an examiner may miss discovering the bear when in fact a bear is present (hence fails in raising the alarm). Again, H0, the null hypothesis, consists of the statement that, “There is no bear”, wherein, if a wolf is indeed present, is a type II error on the part of the investigator.

Here, the bear either exists or does not exist within given circumstances, the question arises here is if it is correctly identified or not, either missing detecting it when it is present, or identifying it when it is not present.