

# ALGORITHMIC NARRATION FOR DEMYSTIFYING COMPUTER SCIENCE AND ENGINEERING UNDERGRADUATE PROJECTS

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**Abstract-**The importance of a well implemented academic project cannot be overemphasized, especially in the area of Computer Science and Engineering. This work is aimed at making Computer Science and Engineering final year undergraduate projects easier for both the students involved and the supervisor. This key objective is achieved through the evolution of algorithmic narrations. The four major areas covered are Research Abstracts, Literature Review, Introductory Chapter, and Reference Section. The corresponding algorithms developed to achieve these are: Research Abstracts Check Algorithm (RACA), Literature Bank Generation Algorithm (LBGA), Introductory Chapter Check Algorithm (ICCA) and Partial Reference Review Algorithm (PRRA). This work is based on practical experiences of the researchers on academic project supervision at both undergraduate and graduate levels, in Computer Science and Engineering. By way of evaluation, the algorithmic strategies presented in this work were applied in real life supervision of six undergraduate projects between August 2020 and April 2021. The overall project completion time is estimated to have been reduced by about 2 months, compared to the outcome of previous supervisions in the year 2019 to 2020. Thus, this work is expected to be very useful to both students and supervisors involved in undergraduate Computer Science and Engineering projects.

**Keywords-** Algorithms, Literature Bank, Search Engine, Web, Research Abstract.

## 1.0 INTRODUCTION

This research presents algorithmic narrations for handling a number of key areas in a typical Computer Science and Engineering (CSE) undergraduate project. Research has shown that undergraduate projects could be herculean tasks both for the supervisors [1] and the supervisees, if the whole process is not well organized. This work demystifies project handling in that regard. It presents four new algorithms - Research Abstracts Check Algorithm (RACA), Literature Bank Generation (LBGA), Introductory Chapter Check Algorithm (ICCA) and Partial Reference Review Algorithm (PRRA) as shown in Fig. 1.

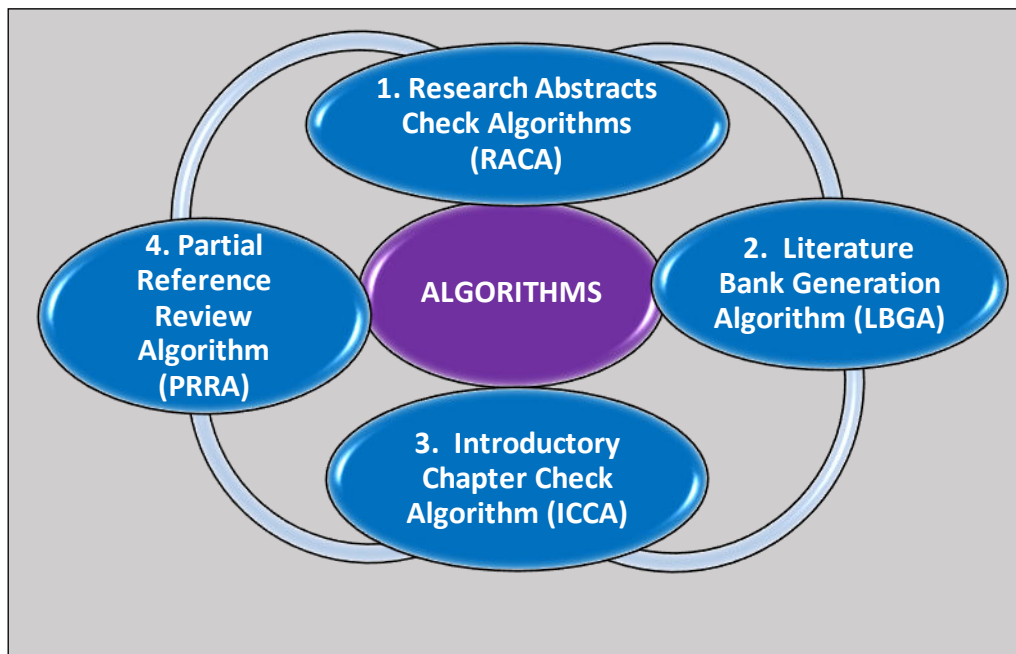


Fig.1: Four Algorithmic Narrations Covered

The Research Abstracts Check Algorithm (RACA) is used to check the research abstract, to ensure it is in a standard well-structured format, while the Literature Bank Generation Algorithm (LBGA) is used to generate a literature bank. The literature bank is a reservoir of relevant materials to be used for research survey. Furthermore, the Introductory Chapter Check Algorithm (ICCA) is an important guide to writing of well-organized introductory chapter [2]. Finally, the Partial Reference Review Algorithm (PRRA) is used for checking the reference section of a research paper for correctness.

## 2.0 RESEARCH ABSTRACT CHECK ALGORITHM (RACA)

Developing and writing a good research abstract in CSE Undergraduate projects is of key importance. An abstract is a self-contained [3] summary of the main research. In scientific research, there could be a working abstract [4], which may not be a final one, but gets updated in the course of a research. The writing of the final abstract is done at the conclusion of the whole work. A number of search engines [5] first refer to abstracts and their keywords [6] when searching for the main documents. Since an abstract is expected to be self-contained, it implies that a badly written abstract automatically gives a bad impression of the main research. Fig. 2 is a simple workflow [7] of RACA, and as clearly shown in the figure, a well written research abstract in CSE undergraduate project should contain at least four major components, numbered chronologically from 1 to 4. These components can also be looked at in terms of sections or paragraphs.

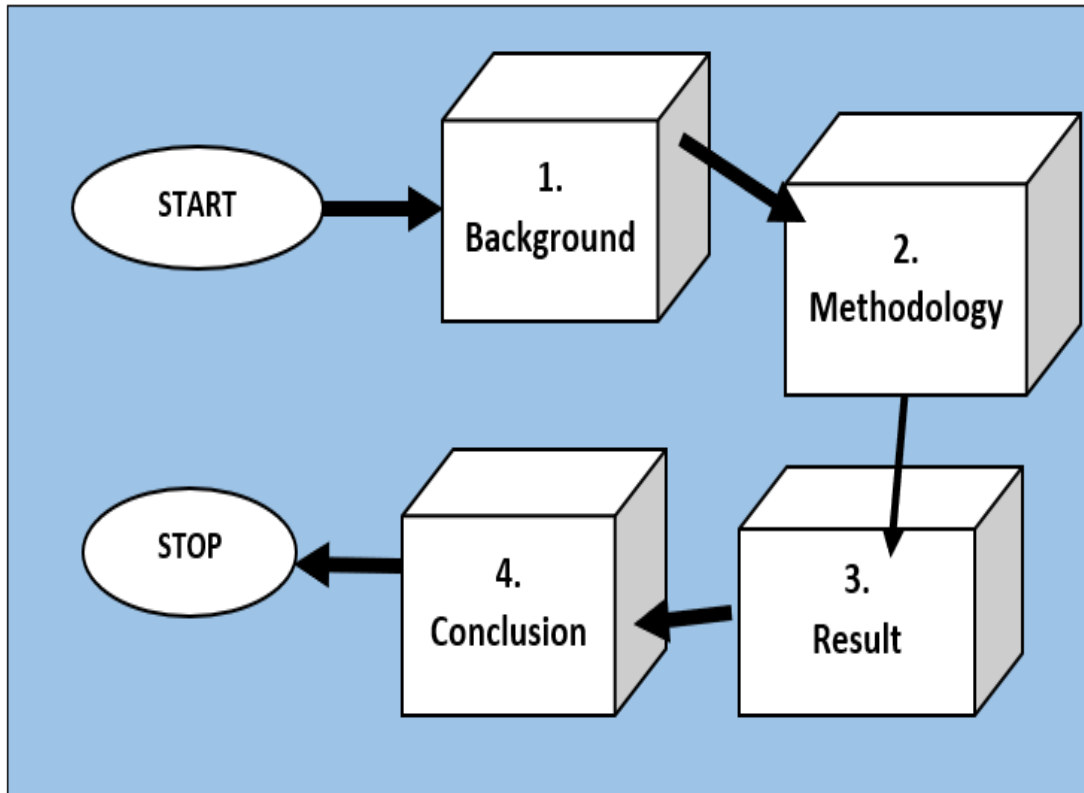


Fig.2: Workflow of a CSE Undergraduate Project Abstract

The background of the scientific writing [8] should present a brief introduction of the work, while the methodology section [9] briefly explains the steps being taken to solve the problem. In CSE undergraduate projects, some of the things that require clarifications in the methodology section are the specific algorithmic techniques [10], programming language [11], databases [12], analytical steps [13] and other tools applied in tackling the research problem. The next section of the abstract is the result, which is followed by a brief conclusion.

### 2.1 Illustration of Abstract Analysis

An illustrative outcome of abstract analysis based on RACA is shown in Fig.3. The abstract was extracted from a research paper titled “Construction of Cryptographic e-Tags using Chronological Binary Transforms” [14].

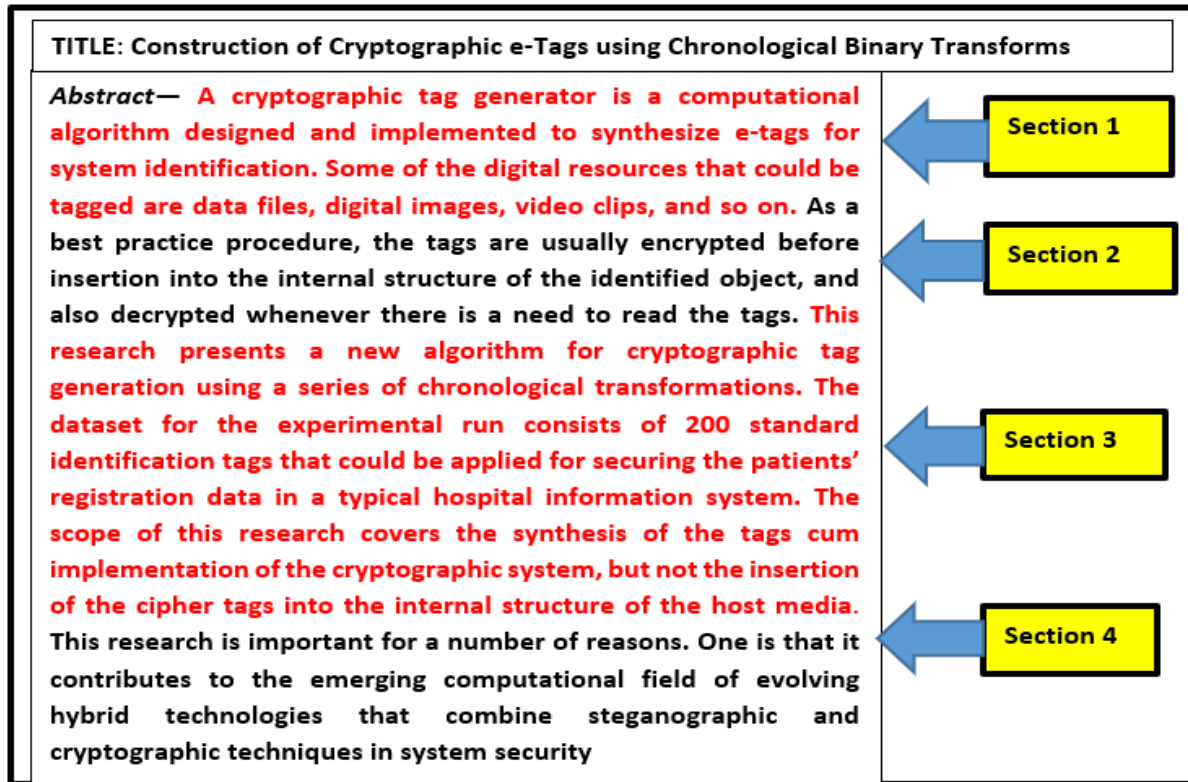


Fig. 3: Sample Analysis of Research Abstract (Source: [14])

In Fig.3, the contents of the abstract are demarcated using red and black colorations, with the section labels indicated at the right-hand side using yellow colouration. Thus, RACA is an important guide for a supervisor who uses it to ensure that all the four sections of a standard abstract are well represented. RACA helps a student researcher to be able to write a more appropriate abstract. Moreover, RACA can also be useful to an independent reviewer, who uses it to analyze any abstract as done in Fig. 3.

**2.2 Resources for CSE Abstracts**

There are a number of specialized resources freely available for accessing and extracting CSE abstracts. One of such resources is the book of abstracts in conference proceedings. Ten examples are outlined in Table I.

TABLE I: CSE ABSTRACTS RESOURCES

S/N	Conference Code	Conference Nomenclature / Narration
1	ICSD 2019	Proceedings of 7th International Conference on Sustainable Development [15]
2	SOFSEM 2020	Proceedings of 46th International Conference on Current Trends in Theory and Practice of Informatics [16]
3	ICEST 2020	Proceedings of 55th International Scientific Conference on

S/N	Conference Code	Conference Nomenclature / Narration
		Information, Communication and Energy Systems and Technologies [17]
4	INSODE 2019	Proceeding of the 9th World Conference on Innovation and Computer Science [18]
5	WCECS 2019	Proceedings of the 27th World Congress on Engineering and Computer Science [19]
6	ICCSA 2018	Proceedings of the 18th International Conference on Computational Science and Its Applications [20]
7	GRAPP 2020	Proceedings of the 15th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications [21]
8	ICATCES2020	Proceedings of International Conference on Advanced Technologies, Computer Engineering and Science [22].
9	HELMETO 2020	Proceedings of the Second International Workshop on Higher Education Learning Methodologies and Technologies Online [23].
10	ANZCC 2020	Proceedings of the 2020 Australian and New Zealand Control Conference [24].

### 3.0 LITERATURE BANK GENERATION ALGORITHM (LBGA)

The use of literature bank generation technique presented in this research is expected to improve the quality and speed of completion of literature reviews [25] in CSE undergraduate researches. Literature review is a key stage in academic research in CSE. It involves going the extra mile to dig deep into the works of other researchers, and thus, using the wealth of knowledge gathered in order to substantiate the current work. The importance of literature review in CSE research is in line with the age long paradigm that one does not need to re-invent the wheel [26]. Literature review is required to be in-depth as well extensive [27]. The flowchart for literature bank generation algorithm (LBGA), which could be used to speed up the completion of literature review in Computer Science and Engineering undergraduate research is shown in Fig. 4.

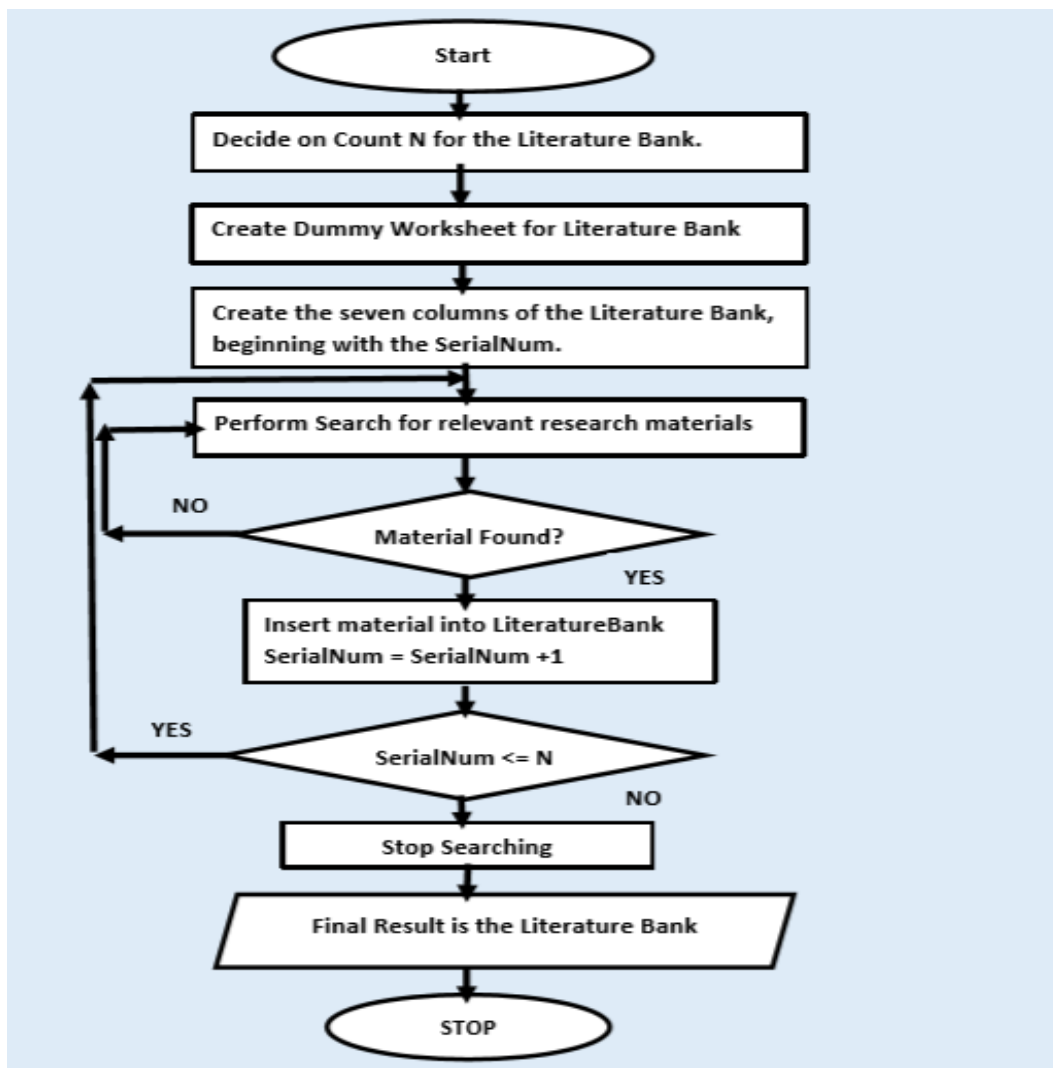


Fig.4: Flowchart for Literature Bank Generation Algorithm

A sample result from literature bank generation is shown in Table II. It is important to reiterate that Literature Bank Generation should be intentional. Thus, the focus of search and store must be for materials that are relevant to the topic of the proposed research. For instance, the contents of the literature bank in Table II are intended for research on Blockchain Technology [28, 29, 30, 31, 32]. The five major fields stored in the literature bank are serial number, author, title of work, DocTypeYear (for storing the type of document and year of publication), and a brief extract from the document including the page where it was extracted.

**TABLE II: SAMPLE OUTPUT FROM LITERATURE BANK GENERATION**

SN	Author	Title	DocTypeYear	Extract
1	M. Wang, Y. Wu, B. Chen and M.Evans [28]	Blockchain and Supply Chain Management: A New Paradigm for Supply Chain Integration and Collaboration	Journal of Operations and Supply Chain Management, 2020.	Three blockchain generations are 1.0, 2.0 and 3.0. The first is one is a core technology in creating cryptocurrencies (pg. 112).
2	I. Utakaeva [29]	Directions and features of application of the blockchain technology	Journal of Physics: Conference Series, 2019.	Integration of blockchain into a digital economy requires a sound regulatory framework (pg. 4)
3	S. Makridakis and K. Christodoulou [30]	Blockchain: Current Challenges and Future Prospects/Applications	Future Internet, 2019.	Smart contracts are very key to executing diverse transactions and applications in IoT.
4	P. A. Corten [31]	Implementation of Blockchain Powered Smart Contracts in Governmental Services	Book Published by Delft Univ, 2018.	Cryptographic algorithms are important in ensuring blockchain immutability.
5	N.Shanthi, R.Suvitha and R.C.Suganthe.[32]	Blockchain-Based E-Voting in P2P Network.	Journal of Critical Reviews, 2020.	Proof of Work is a type of Consensus Algorithm (pg. 339)

A literature bank is very important because, once it is generated, it turns out to be a ready asset that motivates the researcher towards a more creative, innovative, and progressive research.

**4.0 INTRODUCTORY CHAPTER CHECK ALGORITHM (ICCA)**

In every undergraduate project in Computer Science and Engineering, the introductory chapter is usually the first chapter. This is commonly known as Chapter One. It gives a very concise background of the entire work. The necessity for an algorithmic narration stems from the fact that any fundamental error at this stage, may be carried along to the detriment of the entire computational project. One way to describe this is to use the real time systems reliability design [33] acronym GICFT (Get –It- Correct-First-Time). This paradigm is also used in Six-Sigma [34] design principles where it is known as DRIFT (Do It Right First Time). It follows that the introductory chapter has to be as accurate and clear as possible, so that it will have a positive

effect on the subsequent contents, thus the need for algorithmic narration. The ICCA works through what is known as Q9 Puzzle. The Q9 Puzzle consists of a total of nine questions or puzzles, which if carefully answered by a CSE research, he or she is expected to complete the Chapter One without much difficulty. The workflow for the Q9 Puzzle is shown in Fig. 5. As clearly shown, the Q9 Puzzle breaks the whole of Chapter One of a typical CSE undergraduate project into nine sections, labeled as Section 1.0, 1.1, ... to 1.8. Secondly, Q9 Puzzle poses a total of nine questions Q1, Q2, .... Q9 all of which are in red coloration, and begin with the word “**WHAT...**”. For instance, Q2 is “**WHAT** are the Computer Science and Engineering issues or gaps that motivated this research?”. Obviously, a careful answer to Q2 will perfectly fit into section 1.1 of Chapter One of a typical Computer Science and Engineering undergraduate work.

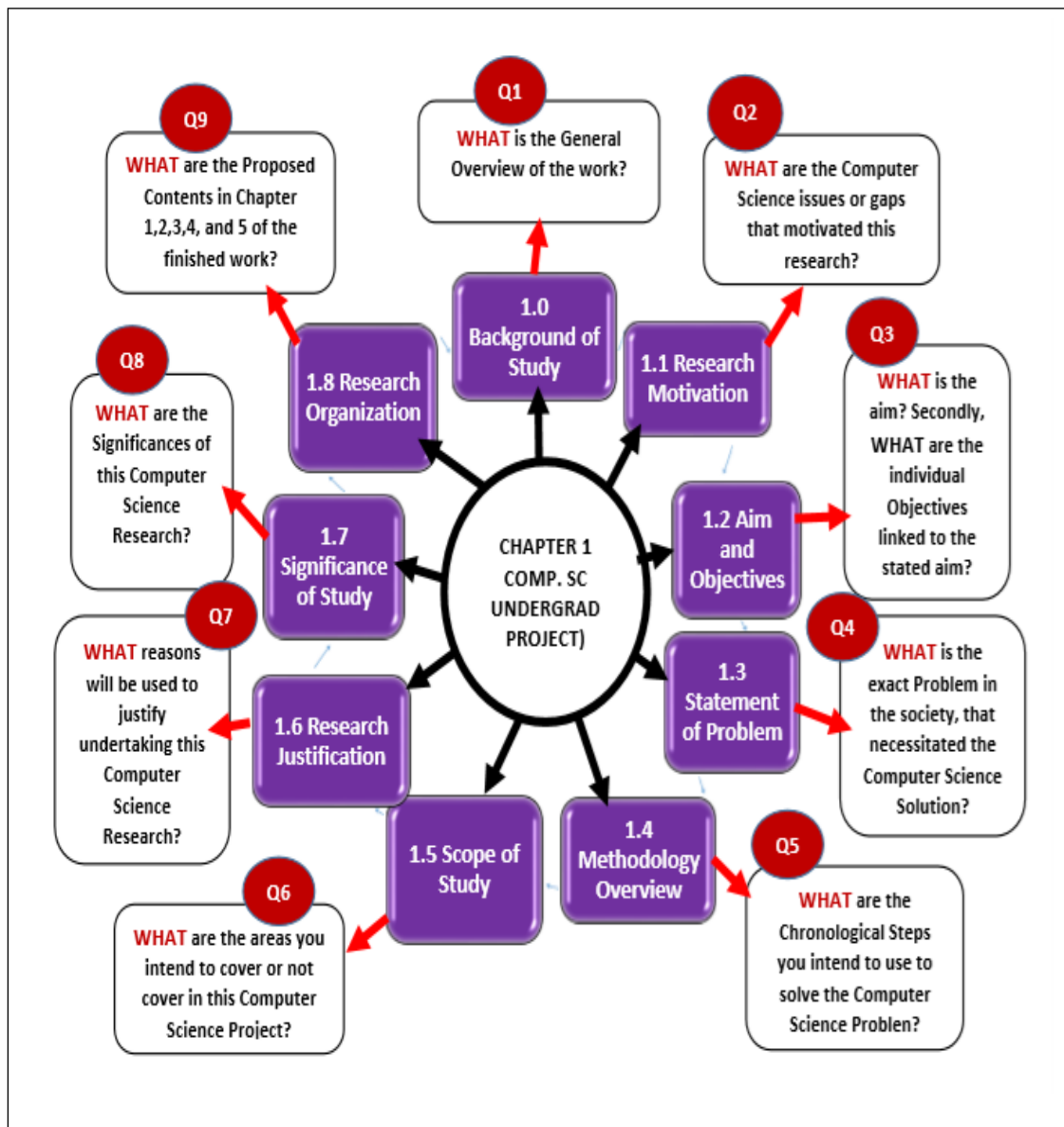


Fig 5: The Workflow of Q9 Puzzle



A collation of answers to all the 9 components of Q9 puzzle will no doubt give rise to a working form of Chapter One. This could then be revised and improved accordingly.

## 5.0 PARTIAL REFERENCE REVIEW ALGORITHM(PRRA)

The Partial Reference Review Algorithm (PRRA) is used to review references in CSE undergraduate project. The word “Partial” is retained in the nomenclature [35] of this algorithm based on the fact that at the moment, this algorithm covers only a very minimal aspect of referencing. Thus, it is expected to be further improved in future researches. However, at the moment it reminds an undergraduate of the rules of referencing research materials downloaded from the web, as shown in Fig.6.

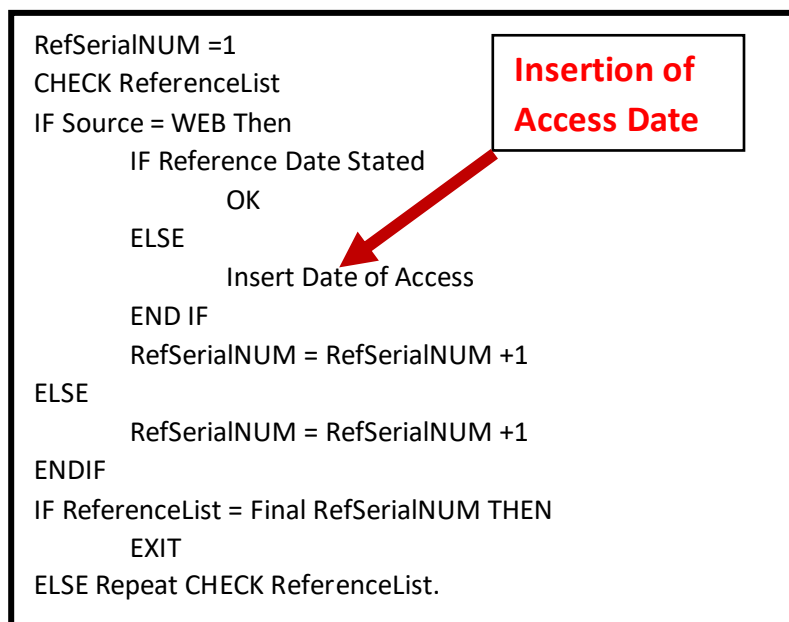


Fig.6: Web-Source Reference Check Algorithm

## 5.1 An Illustration of Reference Checks

A sample output of the use of reference check algorithm to scan a minimal reference list of four items is shown in Fig.7. As shown, references 1 to 3 are appropriately written, while the fourth one is detected to be wrongly written. The major reason is that the research material was accessed from a website, with the source of the material clearly stated, but the date of access was omitted. In scientific research, it is a wrong to omit the date of access, whenever a website is indicated in a reference list. The reason is that the web is dynamic [36]. Thus, it is possible for a webpage to be shutdown either by the publisher, or for other reasons. Stating the exact date of access is the only way for a researcher to prove that a currently non-accessible website was actually accessed some times in the past.

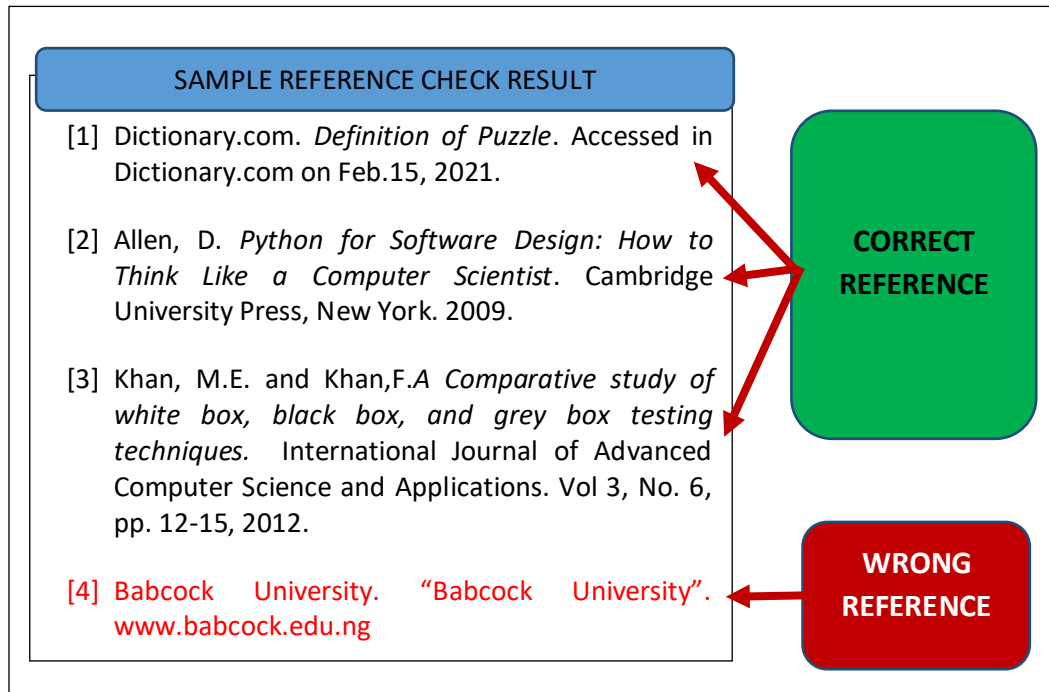


Fig. 7: Sample Reference Check Result

**6.0 CONCLUSION:**

This research has presented four new algorithms that could be of immense benefit not just to Computer Science and Engineering students undertaking their final year projects, but other researchers. These are Research Abstracts Check Algorithm (RACA), Literature Bank Generation Algorithm (LBGA), Introductory Chapter Check Algorithm (ICCA) and Partial Reference Review Algorithm (PRRA). These algorithms were presented in very unambiguous ways, with relevant illustrations, workflows, flowcharts [37], and explanation. The Q9 Puzzle which is very important in tackling Chapter One of Computer Science and Engineering undergraduate projects was discussed using a workflow. The algorithms and strategies presented in this work have been applied in real life supervision of six undergraduate projects by the researcher between August 2020 and April 2021. It is estimated to have reduced the project completion time by about 2 months, compared to previous supervisions in the year 2019 to 2020. Future works will focus on covering the entire project stages from Chapter 1 to 5, and also applying artificial intelligence [38] techniques with the aim of reducing or totally eliminating areas of human interventions existing in the current work.

**CONFLICT OF INTEREST**

The authors declare no conflict of interest.

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