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*Abstract*—This electronic document is a “live” template and already defines the components of your paper [title, text, heads, etc.] in its style sheet. *\*CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract*. (*Abstract*)

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# Introduction

In every software system after release, the maintenance phase continues, and it evolves constantly to provide the functionality needed and to incorporate new features. The needs of customers change. During the maintenance phase, regression testing is performed to find any bugs that might have been introduced. Testing is an important part of developing reliable software. Unfortunately, specifications are often neglected, and implementation is hindered by a range of factors such as incomplete planning, time constraints, limited automation, and undifferentiated costs. Test cases are a set of specific and detailed conditions needed for software testing. Test cases consist of three components: input parameters, execution conditions, and expected results. Generally, the requirements of a test suite (referred to as a set of at least one test case) evolve as the software is developed. Furthermore, test case selection can be defined as the process of selecting a subset of test cases within a domain based on predetermined criteria. Using them may optimize fault detection by eliminating redundant data and unnecessary testing, and by determining which testing strategy is most effective [1]. By applying two nature-inspired metaheuristic techniques to regression testing in this paper which is Particular Swarm Optimization and Firefly Algorithm in order to minimize the time spent on regression testing by selecting the test cases and comparing their performance.

Therefore, let's have more information about the Test Case and both algorithms.

* ***Test case selection*** is a method first introduced by Fischer in 1977 for software maintenance, it is based on specific and complete conditions called test cases, and is the process of raising the most relevant test cases for a change or update to SUT. As inputs to the testing process, test cases act as executional conditions with an expected outcome. In software, the number of test cases referred to as the test suite, increases with its evolution [2].
* ***Particle Swarm Optimization*** refers to an evolutionary computation method. In PSO, all particles are connected by their velocity. The particle velocities are adjusted dynamically in the search space based on their historical behavior. During the search process, the particles are therefore likely to fly toward the best search region.

In the PSO algorithm, three global variables are monitored:

* + The target value.
  + Global best (gBest) determines which particle's data is closest to that of the target.
  + Stopping value determines when the algorithm does not detect the Target so they should stop.

Each particle in the PSO algorithm includes:

* Data representing possible solutions
* A Velocity value, which indicates how much the data can be changed.
* Personal best (pBest) value, which means that the particle data is closest to the target [3].
* ***Firefly algorithm*** it is a novel method that was inspired by nature, and it's extensively utilized to solve the minimization problem. It can also efficiently prioritize the test cases created. The flash of fireflies attracts other fireflies in the vicinity. Flashes may be created by associating them with the objective function that has to be improved, allowing for the creation of novel optimization techniques. The Firefly algorithm is based on three assumptions.

* + All fireflies are monogamous. Every firefly attracts or is attracted to other fireflies in some way. Any firefly will be attracted to any other firefly, regardless of species.
* The brightness of the firefly has direct proportional to its appeal.
  + As fireflies are drawn to other available fireflies, the firefly's brightness becomes a priority among them when ranking attractiveness.
* If a more enticing firefly is not found in nearby regions, the fireflies will move randomly.
  + If there are two or more fireflies had the same brightness [4].

# Related work

According to [5] they have proposed using Particle Swarm Optimization (PSO) to solve the TC selection problem. In their study, PSO was used to maximize requirement coverage and to assess the cost (execution effort) of the Test case selections. Researchers devised a constrained PSO method in which the execution effort serves as a search constraint and the fitness function is the requirements coverage. They created a Binary Constrained PSO (BCPSO) and a hybrid method, BCPSO-FS, that improved the performance of the BCPSO by combining the Forward Selection (FS) algorithm, also known as a greedy search strategy, with the BCPSO. BCPSO and BCPSO-FS outperformed the results obtained by a Random search in the experiments, proving the potential of applying PSO to TC selection. When compared to its individual components, the BCPSO-FS performed well. The high performance of BCPSO-FS was achieved by combining the global search of BCPSO with the local search of the FS algorithm.

In [6], the paper aims to present an improved test selection optimization model that considers the degree of ambiguity in fault isolation.The model makes use of a matrix of fault test dependency to model the relationship between system faults and test groups. In the proposed model the objective function is used to minimize the test cost under the constraints of Fault Detection Rate (FDR) and fault isolation rate (FIR). For solving the enhanced test selection optimization model, they are using the improved chaotic discrete particle swarm optimization (PSO) algorithm.

In [7], Ant Colony and Hybrid Particle Swarm Optimization Algorithms are compared. In the instance of ACO, less than 11% of test cases were able to detect 84.2 percent of problems while requiring just 8.7% of total time,

including the algorithm's execution time. The best of 30 runs was picked as the observed result for Mutation Probability 1 percent, 2 percent, and 5 percent, respectively, using a hybrid PSO algorithm with 30 particles and 500 iterations in each run.

In comparison to ACO, Hybrid PSO can detect 84.21 percent of problems with only 0.7 percent of total test cases, which is very cost-effective, even though the operating time of Hybrid PSO is much longer. Both algorithms are clearly superior at selecting regression test cases, as evidenced by the results. In a variety of test circumstances, Hybrid PSO outperforms ACO, but it takes longer to run than ACO. During test case selection, they can save about 90% of the execution time.

The method proposed by [8] is a hybrid method for reduction of test cases using meta-heuristics. PSO uses particles' behavior as a basis, whereas GA employs evolutionary algorithms (EAs) for mutation operators. To conduct effective testing, one must select a minimal set of test cases that cover all possible faults and bugs in a short period. These activities can be effectively performed through regression testing.

We present a detailed analysis of regression testing, its techniques, and meta-heuristic approaches used to select the minimum number of test cases that cover all faults and bugs in the shortest amount of time. they discuss this in this paper.

The authors in this paper [9] proposed a hybrid approach which is a Hybrid Ant-Colony and Genetic Algorithm that can select test cases to reduce the cost and time of the development process without compromising the efficiency and test coverage of test case selection. The proposed approach is worked as follows: First they apply ACO over the component diagram, then over the results of ACO further apply GA then repeat until stop criteria are met. The output of this approach is a reduced set of test cases. It will have stopped if it meets one of these criteria: the test cases limit total execution time; or by checking whether all the faults have been covered or not. The result of this technique shows that it can achieve 100% fault coverage in 33% of test cases.

The authors in this paper [10] developed two mechanisms for test case selection which considered two objectives: maximize branch covers while minimizing execution time. Their proposed work is based on multi-objective Particle Swarm Optimization that aims to optimize

two objectives at the same time. Also, they have created a hybrid multi-objective selection algorithm to improve the results. They developed hybrid algorithms by adding local search capabilities to the Binary Multi-Objective Particle Swarm Optimization with Crowding distance and Roulette wheel algorithm. The local search explores the neighborhood solution to obtain the better one. They conclude that the local search mechanism indeed improved the algorithm, and the hybrid algorithms are competitive multi-objective search strategies.

In [11]the authors proposed modified probability formula of Ant colony optimization algorithm to get the best bath through enhance execution time with all faults covered. They prove the Effectiveness of proposed techniques through the Average Percentage Faults Detection (APFD) metric. They compared test case selection and prioritization approach for modified ACO with the equivalent traditional ACO that found the modified ACO is providing effective than traditional ACO and has less execution time.

In [12] the authors implemented the proposed ACO technique . that analyzed for forty runs of the tool on two C++ sample programs CollAdmission and HotelMgmnt. They evaluate the effectiveness of the ACO technique by applying APFD metrics . That compared the various order No order, Random order, Reverse order, Optimal order, and ACO order of the test cases. The selection and prioritization of the ACO technique show that results that are near to the optimum ordering .

# Prepare Your Paper Before Styling

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## Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

## Units

* Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.
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* Do not mix complete spellings and abbreviations of units: “Wb/m2” or “webers per square meter”, not “webers/m2”. Spell out units when they appear in text: “. . . a few henries”, not “. . . a few H”.

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* Use a zero before decimal points: “0.25”, not “.25”. Use “cm3”, not “cc”. (*bullet list*)

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Number equations consecutively. Equation numbers, within parentheses, are to position flush right, as in (1), using a right tab stop. To make your equations more compact, you may use the solidus ( / ), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

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Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

## Some Common Mistakes

* The word “data” is plural, not singular.
* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
* A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).
* Do not use the word “essentially” to mean “approximately” or “effectively”.
* In your paper title, if the words “that uses” can accurately replace the word “using”, capitalize the “u”; if not, keep using lower-cased.
* Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
* Do not confuse “imply” and “infer”.
* The prefix “non” is not a word; it should be joined to the word it modifies, usually without a hyphen.
* There is no period after the “et” in the Latin abbreviation “et al.”.
* The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

An excellent style manual for science writers is [7].

# Using the Template

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## Authors and Affiliations

**The template is designed for, but not limited to, six authors.** A minimum of one author is required for all conference articles. Author names should be listed starting from left to right and then moving down to the next line. This is the author sequence that will be used in future citations and by indexing services. Names should not be listed in columns nor group by affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

### For papers with more than six authors: Add author names horizontally, moving to a third row if needed for more than 8 authors.

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Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is “Heading 5”. Use “figure caption” for your Figure captions, and “table head” for your table title. Run-in heads, such as “Abstract”, will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named “Heading 1”, “Heading 2”, “Heading 3”, and “Heading 4” are prescribed.

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#### Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

1. Table Type Styles

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1. Sample of a Table footnote. (*Table footnote*)
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##### Acknowledgment *(Heading 5)*

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

##### References

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Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors’ names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [4]. Papers that have been accepted for publication should be cited as “in press” [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

1. Narciso, E.N., Delamaro, M.E. and Nunes, F.D.L.D.S. (2014). Test Case Selection: A Systematic Literature Review. International Journal of Software Engineering and Knowledge Engineering, 24(04), pp.653–676.
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11. N. Sethi, S. Rani, and P. Singh, “Ants optimization for minimal test case selection and prioritization as to reduce the cost of regression testing,” Int. J. Comput. Appl., vol. 100, no. 17, pp. 48–54, 2014.
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13. Jjj

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