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Optimal Solution of Linear Programming Problem Using Python and TORA: A Comparative Analysis

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Abstract: Linear Programming (LP) is a mathematical method to optimize results under certain constraints. With the improvement of computational aids, LP problems have become easy to solve. This study compares two well-known aids: Python's PULP Library and the TORA software. Applying a new LP problem, both aids are compared for accuracy, usability and application for various user groups. The research aims to guide students, teachers and practitioners on choosing the best tool depending on their requirements.

Keywords: Linear Programming Problem, TORA Software, Python Software

I. Introduction

Linear Programming problem (LPP) has wide applications in logistics, finance, operations management and production. Solving LP problems calculative is time-consuming and prone to errors. Thus, software tools such as Python and TORA have gained popularity. As real-world LP problems often involve numerous variables and constraints, solving them manually not only become tedious and time-consuming but also increase the likelihood of errors in calculation and interpretation. To overcome these limitations, software tools have become integral in solving LP models efficiently and accurately. Among these tools, Python and TORA have emerged as popular choices for both academic and practical applications. Python, a versatile programming language, offers powerful libraries like PULP. On the other hand, TORA provides a user-friendly graphical interface, primarily used in educational settings to illustrate the steps of the Simplex method and other operations research algorithms.

This paper evaluates both tools by solving the same LP problem using Python's programmatic approach using PULP library and TORA's Simplex method interface.

Problem Formulation

The new Linear Programming Problem is:

Maximize $\boldsymbol{z = 3x_1 + 6x_2 + 2x_3}$

Subject to constraints:

$3x_1 + 3x_2 + x_3 \leq 10$

$x_1 + 2x_2 + 3x_3 \leq 15$

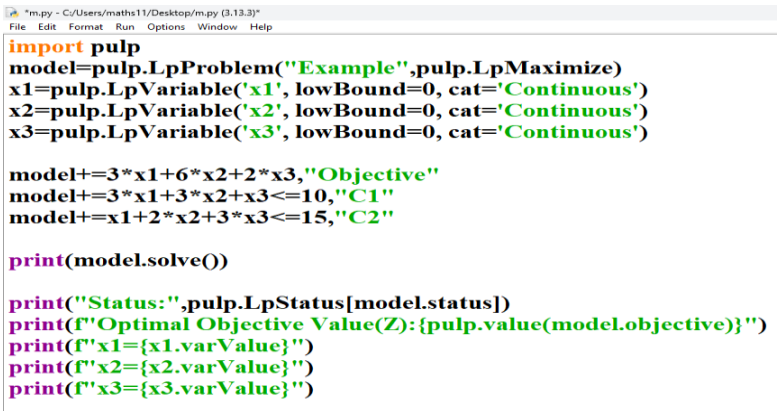
$x_1, x_2, x_3 \geq 0$

This problem represents an optimization scenario such as resource allocation or production planning.

II. Methodology

Solving with Python

Input



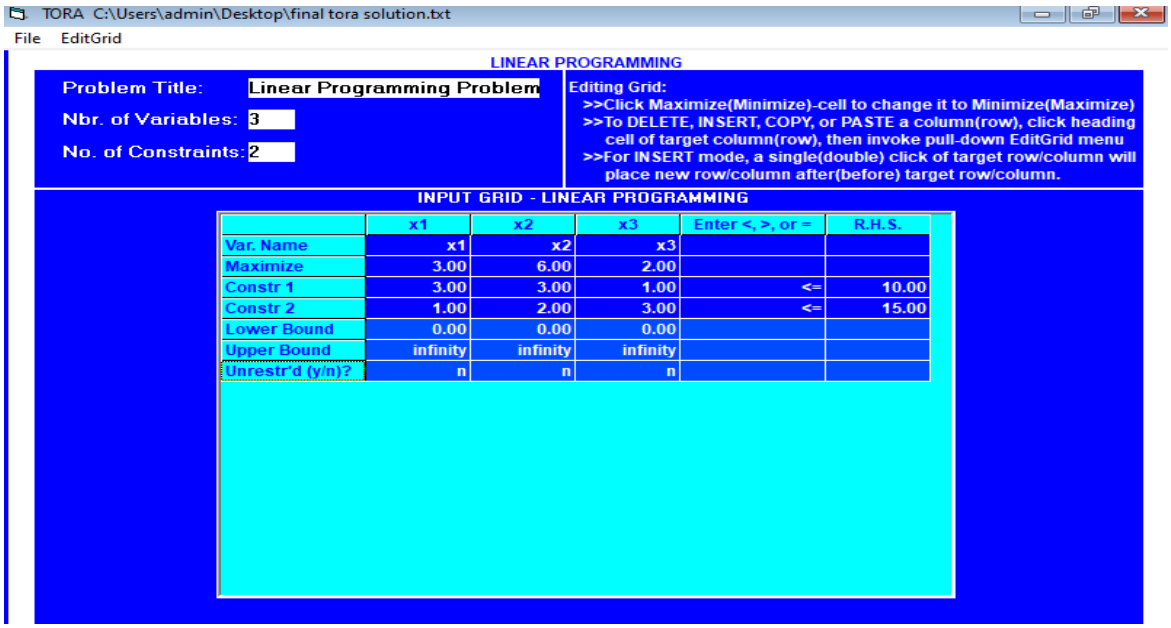
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Output

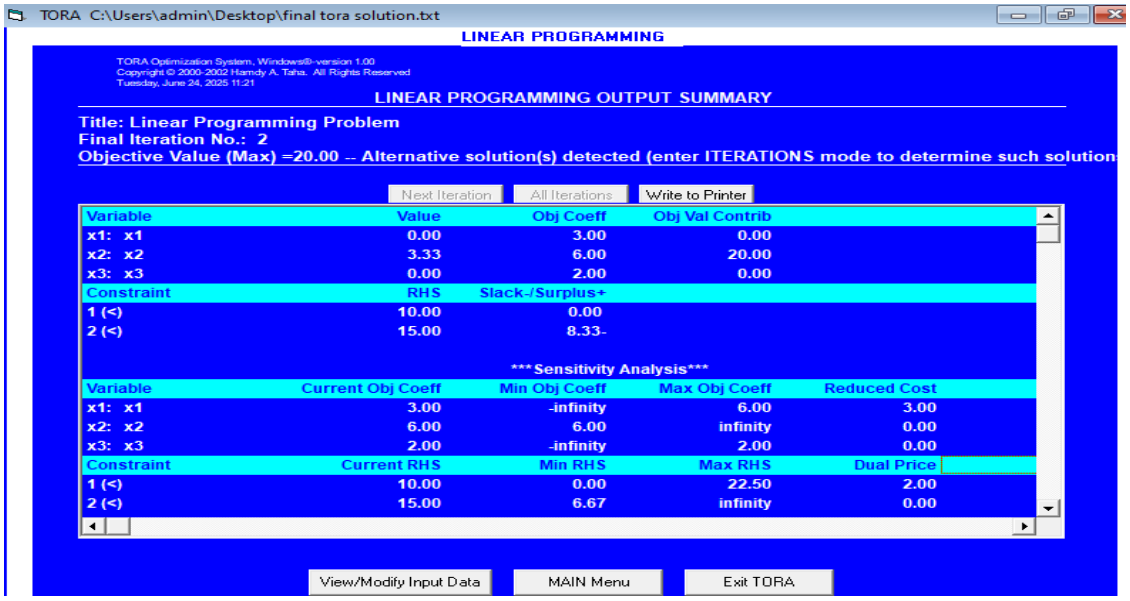


Solving with TORA

Input



Output



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III. Results:

Both tools gives the same optimal solution:

Optimal Solution by using Python

x_1 = 0.00, x_2 = 3.3333333, x_3 = 0.00
$z_{max} = 19.9999998 \sim 20$

Optimal Solution by using TORA

x_1 = 0.00, x_2 = 3.33, x_3 = 0.00
$z_{max} = 20$

Comparison Table:

Criteria	Python (PULP)	TORA Software
Ease of Use	Requires programming Skills	Simple GUI, ideal for beginners
Output Detail	Code-based output	Step-by-step tableau
Speed	Very fast	Fast for small problems
Flexibility	High, allows for automation/scripting	Limited to small-scale problems
Graphical Support	Needs extra libraries (e.g., matplotlib)	Built-in for 2-variable cases
Suitability	Research, automation, large datasets	Education, small manual problems

IV. Discussion:

Both software show efficacy in identifying the best solution. Python's programmatic style provides us with speed, automation, and interfacing into real-world systems such as logistics systems and business application.

TORA, however, is useful for teaching and learning. It decomposes every step of the Simplex method so that a learner can see how the algorithm unfolds internally.

Python does need minimum programming skill but has high scalability and customizability. TORA is ideal for low-scale Problems.

V. Conclusion:

This comparative analysis concludes that Python and TORA are both great tools to solve LP Problems. Yet, their usability is context-dependent: For students and teachers, TORA is perfect as it involves visual, step-by-step learning of the Simplex method. Python is better for researchers, engineers and analysts who require

Scalability and integration with larger systems. Overall, Python is the best choice for professional and industrial use, while TORA is best used in academic environments.

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