

LAPORAN TUGAS AKHIR

**PERBANDINGAN HASIL METODE KARUSH–KUHN–
TUCKER (KKT) DAN ALGORITMA GENETIKA DALAM
OPTIMASI PORTOFOLIO MODEL MEAN–VaR**

*Comparison of Portfolio Optimization Results Using the Karush–
Kuhn–Tucker (KKT) Method and Genetic Algorithm in the Mean–
VaR Model*



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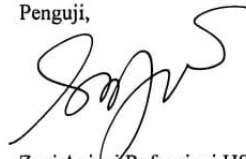
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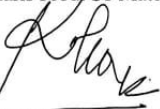
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ABSTRAK

PERBANDINGAN HASIL METODE KARUSH–KUHN–TUCKER (KKT) DAN ALGORITMA GENETIKA DALAM OPTIMASI PORTOFOLIO MODEL MEAN–VaR

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Penelitian ini bertujuan untuk membandingkan hasil metode Karush–Kuhn–Tucker (KKT) dan Algoritma Genetika (GA) dalam optimasi portofolio menggunakan model *Mean–Value at Risk* (*Mean–VaR*). Model *Mean–VaR* digunakan untuk menentukan bobot portofolio optimal dengan meminimalkan risiko yang diukur menggunakan *Value at Risk* (VaR) serta mempertimbangkan *expected return* portofolio. Data yang digunakan berupa harga penutupan harian lima saham yang tergabung dalam indeks IDX30, yaitu BBKA, ADRO, ICBP, TLKM, dan KLBF selama periode 2 Januari 2025 hingga 30 Desember 2025. Metode KKT diterapkan melalui pembentukan fungsi Lagrangian dan penyelesaian kondisi optimalitas yang meliputi kondisi stasioner, kelayakan primal, kelayakan dual, dan *complementary %slackness*. Karena model yang diperoleh bersifat nonlinier, penyelesaian numerik dilakukan menggunakan metode *Sequential Least Squares Programming* (SLSQP). Sementara itu, Algoritma Genetika diterapkan sebagai metode optimasi heuristik berbasis evolusi dengan ukuran populasi 50, jumlah generasi 200, laju mutasi 0,1, dan ukuran elitisme 2. Kinerja portofolio hasil optimasi dievaluasi menggunakan *expected return*, *Value at Risk* (VaR), dan *Sharpe Ratio*. Hasil penelitian menunjukkan bahwa kedua metode menghasilkan bobot portofolio yang memenuhi seluruh kendala optimasi. Komposisi portofolio yang diperoleh dari kedua metode menempatkan saham ICBP dan BBKA sebagai aset dengan bobot terbesar dalam portofolio. Berdasarkan nilai *expected return*, VaR, dan *Sharpe Ratio* yang diperoleh, kedua metode menghasilkan nilai evaluasi portofolio dengan selisih yang relatif kecil. Selain itu, Algoritma Genetika menghasilkan solusi *feasible* yang memenuhi seluruh kendala optimasi sehingga dapat digunakan sebagai alternatif dalam penyelesaian masalah optimasi portofolio nonlinier berkendala pada model *Mean–VaR*.

Kata kunci: optimasi portofolio, *Mean–VaR*, *Value at Risk*, Karush–Kuhn–Tucker, Algoritma Genetika, *Sharpe Ratio*.

ABSTRACT

Comparison of Portfolio Optimization Results Using the Karush–Kuhn–Tucker (KKT) Method and Genetic Algorithm in the Mean–VaR Model

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This study aims to compare the results of the Karush–Kuhn–Tucker (KKT) method and the Genetic Algorithm (GA) in portfolio optimization using the Mean–Value at Risk (Mean–VaR) model. The Mean–VaR model is employed to determine optimal portfolio weights by minimizing risk measured through Value at Risk (VaR) while considering the portfolio's expected return. The data used in this study consist of the daily closing prices of five stocks listed in the IDX30 index, namely BBCA, ADRO, ICBP, TLKM, and KLBF, during the period from January 2, 2025, to December 30, 2025. The KKT method was implemented through the construction of a Lagrangian function and the solution of optimality conditions, including stationarity, primal feasibility, dual feasibility, and complementary slackness conditions. Since the resulting model is nonlinear, numerical optimization was performed using the Sequential Least Squares Programming (SLSQP) method. Meanwhile, the Genetic Algorithm was applied as an evolutionary heuristic optimization method with a population size of 50, 200 generations, a mutation rate of 0.1, and an elite size of 2. The performance of the optimized portfolios was evaluated using expected return, Value at Risk (VaR), and the Sharpe Ratio. The results indicate that both methods produce portfolio weights that satisfy all optimization constraints. The portfolio compositions obtained from both methods allocate the largest weights to ICBP and BBCA. Based on the expected return, VaR, and Sharpe Ratio values obtained, the portfolio evaluation results produced by the two methods differ only slightly. Furthermore, the Genetic Algorithm generates feasible solutions that satisfy all optimization constraints, indicating that it can be used as an alternative approach for solving constrained nonlinear portfolio optimization problems under the Mean–VaR model.

Keywords: portfolio optimization, Mean–VaR, Value at Risk, Karush–Kuhn–Tucker, Genetic Algorithm, Sharpe Ratio.

