

**SKRIPSI**

**METODE FUZZY C-MEANS DAN PARTICLE SWARM OPTIMIZATION  
PADA PEMBENTUKAN PORTOFOLIO SAHAM INDEKS LQ45**

***FUZZY C-MEANS AND PARTICLE SWARM OPTIMIZATION METHODS  
IN THE FORMATION OF THE LQ45 INDEX STOCK PORTFOLIO***



**AFIFAH OCTAVIA**

**24010121140144**

**DEPARTEMEN MATEMATIKA  
FAKULTAS SAINS DAN MATEMATIKA  
UNIVERSITAS DIPONEGORO  
SEMARANG**

**2025**

**SKRIPSI**

**METODE FUZZY C-MEANS DAN PARTICLE SWARM OPTIMIZATION  
PADA PEMBENTUKAN PORTOFOLIO SAHAM INDEKS LQ45**

***FUZZY C-MEANS AND PARTICLE SWARM OPTIMIZATION METHODS  
IN THE FORMATION OF LQ45 INDEX STOCK PORTFOLIO***

Diajukan untuk memenuhi salah satu syarat memperoleh derajat  
Sarjana Matematika (S.Mat)



AFIFAH OCTAVIA

24010121140144

**DEPARTEMEN MATEMATIKA  
FAKULTAS SAINS DAN MATEMATIKA  
UNIVERSITAS DIPONEGORO  
SEMARANG**

**2025**

**HALAMAN PENGESAHAN**

**SKRIPSI**

**METODE FUZZY C-MEANS DAN PARTICLE SWARM OPTIMIZATION PADA  
PEMBENTUKAN PORTOFOLIO SAHAM INDEKS LQ45**

Telah dipersiapkan dan disusun oleh:

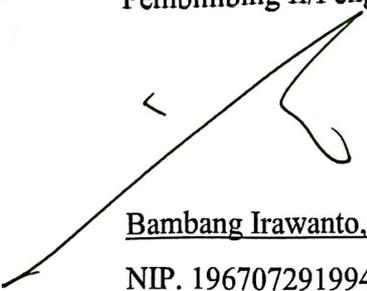
AFIFAH OCTAVIA

24010121140144

Telah dipertahankan di depan Tim Penguji  
pada tanggal 30 September 2025

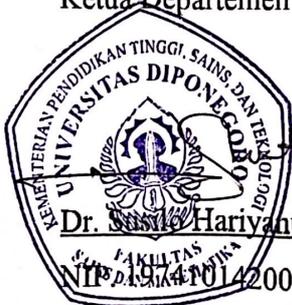
Susunan Tim Penguji

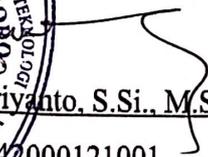
Pembimbing II/Penguji,

  
Bambang Irawanto, S.Si., M.Si.

NIP. 196707291994031001

Ketua Departemen Matematika,



  
Dr. Hariyanto, S.Si., M.Sc.

NIP. 197410142000121001

Penguji,

  
Jovian Dian Pratama, S.Mat., M.Mat.

NIP. 199708282024061002

Pembimbing I/Penguji,

  
Drs. Bayu Surarso, M.Sc., Ph.D.

NIP. 196311051988031001

## ABSTRAK

### METODE FUZZY C-MEANS DAN PARTICLE SWARM OPTIMIZATION PADA PEMBENTUKAN PORTOFOLIO SAHAM INDEKS LQ45

Oleh

Afifah Octavia

24010121140144

Meningkatnya dinamika pasar keuangan dan tingginya tingkat ketidakpastian ekonomi global memerlukan metode analisis yang mampu membantu investor dalam memilih saham secara lebih tepat. Metode *Fuzzy C-Means* (FCM) digunakan untuk mengelompokkan saham indeks LQ45 berdasarkan rasio profitabilitas, seperti *Return on Equity* (ROE), *Net Profit Margin* (NPM), dan *Price to Earnings Ratio* (PER). Penentuan jumlah *cluster* optimal divalidasi menggunakan *Davies-Bouldin Index* (DBI). Setiap *cluster* dipilih saham dengan *expected return* tertinggi, kemudian bobot portofolio dioptimalkan menggunakan *Particle Swarm Optimization* (PSO) dengan tujuan memaksimalkan *Sharpe Ratio*. Hasil penelitian menunjukkan bahwa portofolio optimal terdiri dari tiga saham dengan proporsi bobot BRIS (60.11%), BRPT (20.59%), dan ANTM (19.29%). Risiko portofolio diukur menggunakan *Value at Risk* (VaR) dan *Expected Shortfall* (ES) pada tingkat kepercayaan 95% selama satu bulan, dengan potensi kerugian maksimum sebesar 11,18% serta kemungkinan kerugian terburuk mencapai 14.62%.

**Kata Kunci:** Investasi, Portofolio Saham, Indeks LQ45, Rasio Profitabilitas, *Fuzzy C-Means*, *Davies-Bouldin Index*, *Particle Swarm Optimization*, *Sharpe Ratio*, *Value at Risk*, *Expected Shortfall*.

## ABSTRACT

### FUZZY C-MEANS AND PARTICLE SWARM OPTIMIZATION METHODS IN THE FORMATION OF THE LQ45 INDEX STOCK PORTOFOLIO

By

Afifah Octavia

24010121140144

The increasing dynamics of the financial market and the high level of global economic uncertainty require analysis methods that can help investors choose stocks more accurately. The Fuzzy C-Means (FCM) method is used to cluster LQ45 index stocks based on profitability ratios, such as Return on Equity (ROE), Net Profit Margin (NPM), and Price to Earnings Ratio (PER). The determination of the optimal number of clusters is validated using the Davies-Bouldin Index (DBI). Each cluster selected stocks with the highest expected return, then the portfolio weight was optimized using Particle Swarm Optimization (PSO) with the aim of maximizing the Sharpe Ratio. The results showed that the optimal portfolio consisted of three stocks with weight proportions of BRIS (60.11%), BRPT (20.59%), and ANTM (19.29%). Portfolio risk is measured using Value at Risk (VaR) and Expected Shortfall (ES) at a 95% confidence level for one month, with a maximum potential loss of 11.18% and a worst-case loss of 14.62%.

**Keywords:** Investment, Stock Portfolio, LQ45 Index, Profitability Ratio, Fuzzy C-Means, Davies-Bouldin Index, Particle Swarm Optimization, Sharpe Ratio, Value at Risk, Expected Shortfall.