**Project Summary – Survival Analysis of Heart Failure Clinical Data**

In this project, I conducted an end-to-end statistical analysis of a heart failure clinical dataset (n = 299) to investigate survival patterns and risk factors associated with patient mortality. The workflow combined rigorous data preparation, exploratory statistics, and advanced survival modeling in SAS.

**1. Data Preparation & Understanding**

* Imported and validated the dataset in SAS using PROC IMPORT, PROC CONTENTS, and PROC PRINT to ensure correct variable types and structure.
* Examined key clinical and demographic features, including **age**, **anaemia**, **ejection fraction**, **serum creatinine**, **high blood pressure**, and **death event status**.

**2. Unadjusted Survival Analysis**

* Used PROC LIFETEST to generate **Kaplan-Meier survival curves** comparing patients with and without high blood pressure.
* The log-rank test (p = 0.0358) and Wilcoxon test (p = 0.0264) indicated a statistically significant difference in survival between the two groups.
* Found that patients with high blood pressure had a notably lower median survival time compared to those without.

**3. Adjusted Survival Modeling**

* Built a **Cox Proportional Hazards Model** (PROC PHREG) to assess the effect of high blood pressure while adjusting for other covariates:
  + **Age**, **Ejection Fraction**, **Serum Creatinine**, **Anaemia**, **Creatinine Phosphokinase**, and **Serum Sodium**.
* The model confirmed that high blood pressure remained a significant predictor of mortality (HR = 1.636, p = 0.0213) after adjustment.
* Other strong predictors included **age** (HR = 1.044, p < 0.0001), **serum creatinine** (HR = 1.356, p < 0.0001), and **ejection fraction** (HR = 0.954, p < 0.0001).

**4. Impact & Interpretation**

* The analysis reveals that high blood pressure independently increases the hazard of death in heart failure patients, even after accounting for age and other key clinical variables.
* Such findings have direct implications for patient risk stratification and targeted clinical management.