# Project Requirements: Web-Based Multi-Dimensional Course Performance Analytics Dashboard

This document outlines the requirements for developing a web-based, multi-dimensional course performance analytics dashboard. The system will provide educational institutions with a comprehensive tool to analyze course data, visualize performance trends, and gain predictive insights to support instructional decisions.

## 1. Visualization & Dashboard Home Page

The dashboard's home page will be the central hub for all analytics. It must provide a dynamic and visually appealing overview of course performance. The design should be responsive and optimized for both desktop and mobile viewing.
**Key Visualizations:**
- **Performance Over Time:** Line or area charts showing average grades or pass rates over different semesters.
- **Course-Specific Analytics:** Bar charts comparing performance across different courses, campuses, or instructors.
- **Student Performance Distribution:** Histograms or box plots illustrating the grade distribution within a specific course or semester.
- **Predictive Trends:** A dedicated section displaying predicted performance trends as generated by the AI model.
- **Summary Cards:** Key performance indicators (KPIs) such as overall pass rate, average course grade, and top-performing courses displayed as prominent, easy-to-read cards.

The platform will utilize an interactive charting library such as **Chart.js**, as referenced in the provided reports, to create these visualizations.

## 2. Screens/UI Designs

The application will be structured around the following key screens to facilitate user interaction and provide a clear flow:
- **Home Screen:** Displays a summary dashboard with overall student performance indicators, quick links to filters, recent reports, and alerts for at-risk students.
- **Course Analytics Screen:** Allows users (Educators) to select a specific course or CRN and view detailed analytics, including average grades, attendance rates, and performance trends by semester.
- **Predictive Analytics Screen:** Shows the predicted outcomes for students based on their data starting from the first semester, using AI models to identify students who are at academic risk or trending toward success.
- **Report Generation Screen:** Enables users (Educators) to generate and export customized performance reports (PDF/Excel), with filters for campus, course, CRN, and semester.

- **Admin Panel:** Provides admin users with access to user management, permissions, dashboard settings, and data syncing options.

## 3. User Roles, Access & Authentication

The system will implement a role-based access control system to ensure data security and provide appropriate functionality to different user types.
- **Authentication:** A standard login page will authenticate users. The system must support secure user registration and login.
- **User Roles & Access:**
  - **Instructor (Primary User):**
    - **Access:** Full access to the dashboard.
    - **Views:** Can view data for all courses they are assigned to, and potentially view aggregate data across the entire institution.
    - **Permissions:** Can apply all filters, generate reports, and utilize the AI predictive insights tool.
  - **Administrator/Guest (Secondary User):**
    - **Access:** Limited or view-only access.
    - **Views:** Can view high-level, aggregate data across the institution but may not be able to drill down to individual student or course data unless granted specific permissions.
    - **Permissions:** Can apply filters and generate high-level reports.

## 4. Database Structure & Attributes

The project will use **Firebase Firestore** as the backend database, as specified in the provided documents. The data will be structured into collections and documents. The developer will need to create a secure data model that can handle real-time updates and complex queries.
**Database Collections and Attributes:**
- **courses Collection:**
  - courseId (string, unique ID)
  - courseCode (string, e.g., "CIS-4913")
  - courseName (string, e.g., "Capstone Project - I")
  - courseType (string)
- **instructors Collection:**
  - instructorId (string, unique ID)
  - instructorName (string)
- **campuses Collection:**
  - campusId (string, unique ID)
  - campusName (string, e.g., "Dubai Campus")
- **semesters Collection:**
  - semesterId (string, unique ID)
  - semesterCode (string, e.g., "202420")
- **sections Collection:** (To link courses, instructors, and semesters)
  - sectionId (string, unique ID)
  - crn (string, e.g., "20165")
  - courseId (string, foreign key to courses)
  - instructorId (string, foreign key to instructors)

- semesterId (string, foreign key to semesters)
- campusId (string, foreign key to campuses)
- **students Collection:**
  - studentId (string, HCT ID)
  - studentName (string)
- **performanceData Collection:** (The core data for analytics)
  - dataId (string, unique ID)
  - studentId (string, foreign key to students)
  - sectionId (string, foreign key to sections)
  - assessmentTitle (string, e.g., "Assignment-3")
  - score (number)
  - maxScore (number)

*Note: Dummy data will be provided for development and testing purposes.*

# 5. Dashboard Filtration System

The dashboard must be highly interactive with a robust filtering system. Filters should be available on the main dashboard page and should dynamically update the visualizations and data in real-time. The following filters are required:
- **Semester:** A dropdown or searchable input to select a specific academic semester.
- **CRN:** A searchable input to filter by Course Reference Number.
- **Course Name:** A searchable input to filter by the name of the course.
- **Course Type:** A dropdown to filter by course category (e.g., "CIS," "Engineering").
- **Course:** A dropdown or searchable input to select a specific course code.
- **Campus:** A dropdown to filter data by campus location.

# 6. AI Predictive Analysis

The dashboard will include an advanced AI component to provide predictive insights. The model will analyze historical data to forecast future performance and offer actionable insights.
- **Functionality:** The AI model will be able to answer user queries and provide insights based on the provided data. For example, a user could ask: "What is the projected performance for all courses in semester 1 of 2025?"
- **Key Capabilities:**
  - **Performance Forecasting:** Predict future course performance trends based on historical data.
  - **Intervention Highlighting:** Identify courses that may be at risk of underperformance, allowing instructors to intervene proactively.
  - **Actionable Recommendations:** Offer data-driven suggestions on how to improve course performance.
  - **AI-Powered Search:** Allow instructors to query data using natural language instead of manually applying multiple filters.

The AI model will require access to the historical data stored in the Firestore database for training and inference.

# 7. Report Generation & Export

The dashboard will include a feature to generate and export reports.

- **Format:** Users must be able to export reports in two common formats: **PDF** and **Excel**.
- **Content:** The exported report should reflect the currently filtered data and visualizations on the dashboard. The report should include the charts and the raw data from the filtered view.
- **Accessibility:** The export feature should be easily accessible from the dashboard interface, likely through a dedicated button.

This document serves as the comprehensive blueprint for the development of the analytics dashboard. The developer should use it as a guide to ensure all features are implemented as required.