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GMT 320 Semester Test 2:

Question 1 – 3D Model Generation Process

This report outlines the workflow followed to generate a 3D map of the University of Pretoria Hatfield campus using QGIS. The goal was to digitize campus features, developing a 3D model leveraging elevation data, and compile all work in a portable project structure for sustainable campus planning.​ In response to the SDG 3: Good Health and Wellbeing

**Process Overview**

* **Data Preparation**  
  The UP Campus orthophoto and Lidar datasets were loaded into QGIS 3.34.6-Prizren , a free and open-source Geographic Information System. The coordinate reference system was verified to ensure geospatial accuracy. (Hartebeesthoek Lo-29, EPSG:102567)
* **Feature Digitization**  
  Polygon shapefiles were created for all relevant features (selected campus buildings, vegetation in the form of recreational areas, pathways) using QGIS's digitising tools. Care was taken to assign suitable attribute information (e.g., building names, types) to each feature for further analysis.
* **3D Model Generation**  
  The Lidar data, processed as a raster Digital Surface Model (DSM), was overlaid with digitised features. The “Drape” and “Extrude” 3D styling functionalities in QGIS were used to add height attributes to the building polygons. Vegetation and other features were similarly styled, creating a comprehensive 3D visualization. Building rooftops were generated using the Normalised Digital Surface Model (nDSM) and later on Zonal Statistics were generated on the DSM and Digital Terrain Model (DTM) generated for the ground data extracted from the LiDAR layer after layer classification.
* **3D Visualization**  
  QGIS’s Qgistothreejs Exporter (WebKit) plugin was used to navigate and inspect the extruded features. Adjustments were made to colours, extrusion heights, and lighting to ensure the final 3D scene was realistic and legible.
* **Project Management and Packaging**  
  All layers and their respective files were saved into a dedicated project folder. The QGIS project file (.qgz) referenced only relative paths to ensure portability. The entire workspace was zipped, ready for submission alongside screenshots.

**Software Tools Used**

* **QGIS 3.36**: Primary GIS platform for vector and raster data manipulation, digitisation, and 3D visualisation.
* **QGIS 3D Map View**: For real-time navigation and assessment of 3D scenes.
* **Shapefile Format**: For digitised vector feature storage.
* **Lidar Point Cloud/DSM**: Provided accurate elevation data for 3D modelling. The DSM and nDSM were created using the Export to Raster tool under the Point Cloud Conversion ToolBox.