# CEG5306 Robotics and Embodied AI:
# Homework #3

**Important note:** the due date is 10/10/2025. You should submit your scripts to the folder in CANVAS. Late submission is not allowed unless it is well justified. Please include the Python code in the appendix of the report if computer experiment is involved.

**Q1**. (10 Marks)
Please clone the repository using Git, install all the necessary packages, and explore how the hover state is implemented.

After completing these steps, record a screen capture video showing the hover effect with your name clearly visible on the screen. Upload the video to Google Drive, ensure the sharing setting allows access via link, and submit the link here so our grading assistants can review your work. This practice is intended to help you become more familiar with the coding environment.

Hint:
**Approach 1** (directly install Conda):

1. Install Conda Distribution Installers to your computer: https://www.anaconda.com/download/success
2. Clone repository from github to your laptop:
    a. git clone https://github.com/NUS-HcRL/gym-pybullet-drones.git
    b. p.s. You may use Visual Studio Code, Terminal, Jupyter Notebook, or any of your preferred IDEs or interfaces to manage and run the code. If it does not work on your current operating system, using an Ubuntu virtual machine can be a suitable alternative.
3. Install repository required packages following README
    a. git clone https://github.com/NUS-HcRL/gym-pybullet-drones.git
    b. cd gym-pybullet-drones/
    c. conda create -n drones python=3.10
    d. conda activate drones
    e. pip3 install --upgrade pip
    f. pip3 install -e . # if needed, `sudo apt install build-essential` to install `gcc` and build `pybullet`
4. Run the example flight script
    a. cd gym_pybullet_drones/examples/
    b. python pid.py # position and velocity reference
    c. python pid_velocity.py # desired velocity reference
5. Run the example training script
    a. cd gym_pybullet_drones/examples/
    b. python learn.py # task: single drone hover at z == 1.0
    c. python play.py --model_path results/YOUR_FOLDER_NAME/best_model.zip # play and visualize learned policy after training

d. Make a screen recording video that clearly shows your name next to the GUI to verify that the work was completed by you.

**Approach 2** (install from Visual Studio tools):

1. Download Build Tools:
    a. https://visualstudio.microsoft.com/visual-cpp-build-tools/
    b. Download "Build Tools for Visual Studio 2022"
2. Installation Configuration:
    a. Run the installer
    b. Select "C++ build tools" workload
3. Ensure the following are checked: (we just listed what we tested, other version may also work)
    a. MSVC v143 - VS 2022 C++ x64/x86 build tools
    b. Windows 11 SDK (latest version)
    c. CMake tools for Visual Studio
4. Continue installation after restart:
    a. Same as **Approach 1** from step 2

**Q2**. (10 Marks)

(1). Please try to understand the code and identify the contents of the **observation state** used in the training example. Specify which file you found this information in.

(2). Explain what the **action state** refers to in this context.

(3). Explain what the **reward function** refers to in this context.

A kind hint: You do not need to understand all the codes in this given program before answer all these questions.

**Q3**. (10 Marks)

Please train a control policy to control drone to arrive at the **target position** (0, 0.5, 0.8). (Please write down your idea and make a screen recording video that clearly shows your name next to the GUI to verify that the work was completed by you.)