Assignment 4: CNN for Object Classification and Data Augmentation
Total marks: 100
Due date: 9th of Nov, 2023. (Midnight)

For this assignment, you need to implement a CNN model that can classify 10 different objects in the cifar10 dataset. We will use two main libraries TensorFlow and Keras for this.

a) These are the steps that need to be completed for this part.
   1. Load cifar10 dataset into (train_images, train_labels), (test_images, test_labels).
   2. Implement a CNN architecture that can classify the objects in cifar10. You must use appropriate padding to keep the feature map length and width the same before and after each convolution layer. **Make sure your CNN architecture is not exactly the same as the architecture example shown in the class**.
   3. Train the network on train_images and train_labels. Your program should print the training accuracy after each epoch.
   4. Validated the trained model using the test data (test_images, test_labels). Your program should print the test accuracy. **30**

b) Image augmentation is a technique that can artificially expand the size of a training dataset by creating modified versions of images in the dataset.
   1. Use any two data augmentation techniques that you think should improve your test accuracy. Your program should plot one example of each augmentation technique. Each plot should show an image and the image after augmentation. **20**
   2. Use your augmentation techniques on the training dataset to expand it. Use the expanded training dataset to train your CNN model (the same architecture that you used before but trained on augmented train_images, and train_labels) and report the test accuracy. **20**
   3. If the test accuracy increases or decreases compared to before, logically explain why. **10**
   4. Finally, add dropout regularization on the dense layers of your CNN architecture. Retrain the model and recompute the test accuracy. Report the test accuracy. State your observation: what changes in terms of the network's training, validation, and test accuracy when you use dropout regularization vs when you don't use. **20**

Deliverable:

- Implement the solution on Google Colab platform and upload **BOTH** the .py and .ipynb files on Moodle. Your program should print all the relevant information.
- Submit a description (either in the code file or separately) for part b) 3 and b) 4.

Grading Criteria

1. Your code should run without an error. If it doesn't run, or part of the code doesn't run you will loose 30% of marks (for that part). For example, if part b) of your code doesn't run, you can receive maximum 49 marks (instead of 70) on part b).
2. Late submission: 10% of the awarded marks will be deducted if you are late by one day. 20% for two days. Assignment submission will not be considered if you are more than two days late.

b-1) example plot of augmentation techniques