Lesson 21 (LeNet) LeNet[7] is on of the earliest convolutional networks. It was designed for OCR (optical character recognition) tasks.

(a) Assume LeNet is to be trained using the `MNIST_train_1000.npz` dataset. Determine the shape of the following tensors. Assume parameters are stored in single precision (4 bytes each). How much memory (in megabytes) is needed to store the trained parameters of LeNet for the `MNIST_train_1000.npz` dataset.

	$\mathbf{X}$	
Layer 1	$\mathbf{W}_0$	
	$\mathbf{b}_0$	
	$\mathbf{Z}_1$	
	$\mathbf{A}_{11}$	
	$\mathbf{A}_{12}$	
Layer 2	$\mathbf{W}_1$	
	$\mathbf{b}_1$	
	$\mathbf{Z}_2$	
	$\mathbf{A}_{21}$	
	$\mathbf{A}_{22}$	
	$\mathbf{A}_{23}$	
Layer 3	$\mathbf{W}_2$	
	$\mathbf{b}_2$	
	$\mathbf{Z}_3$	
	$\mathbf{A}_3$	
Layer 4	$\mathbf{W}_3$	
	$\mathbf{b}_3$	
	$\hat{\mathbf{Y}}$	
	$\hat{\mathbf{P}}$	
	Total	

(b) Define LeNet in Keras and check your answers to part (a) using Kera's `.summary()` method.

(c) Train LeNet and use `MNIST_test_1000.npz` to evaluate the accuracy of LeNet. Compare LeNet's accuracy rate to a baseline accuracy rate and a human accuracy rate.

[7] LeCun et al., Gradient-Based Learning Applied to Document Recognition, Proc. IEEE 86(11): 2278–2324, 1998.