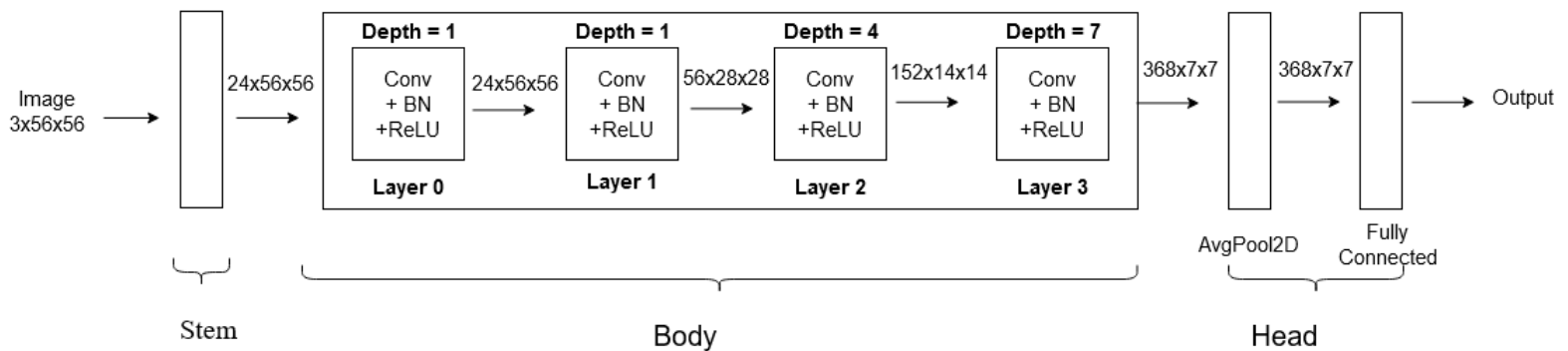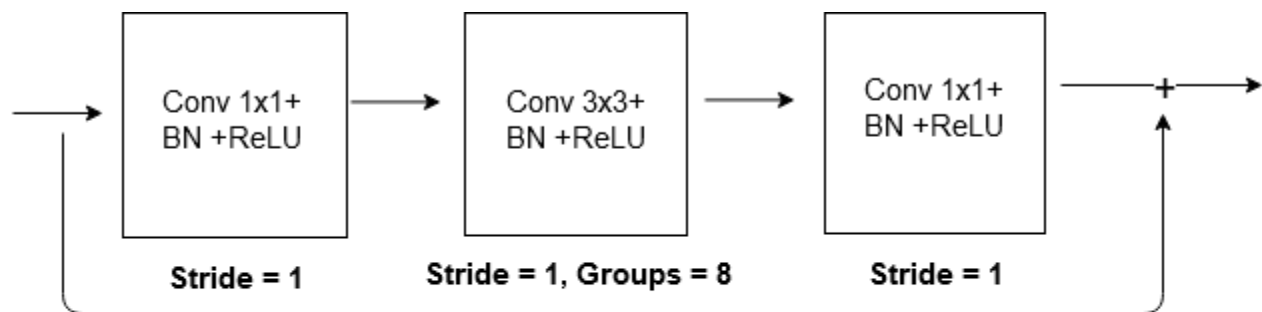# Project 02 – Networks
CNN – CS6301.502 – Kapil Gautam

Section 1 – Design

    a) Include 3 figures (either drawn by hand or in a drawing program)
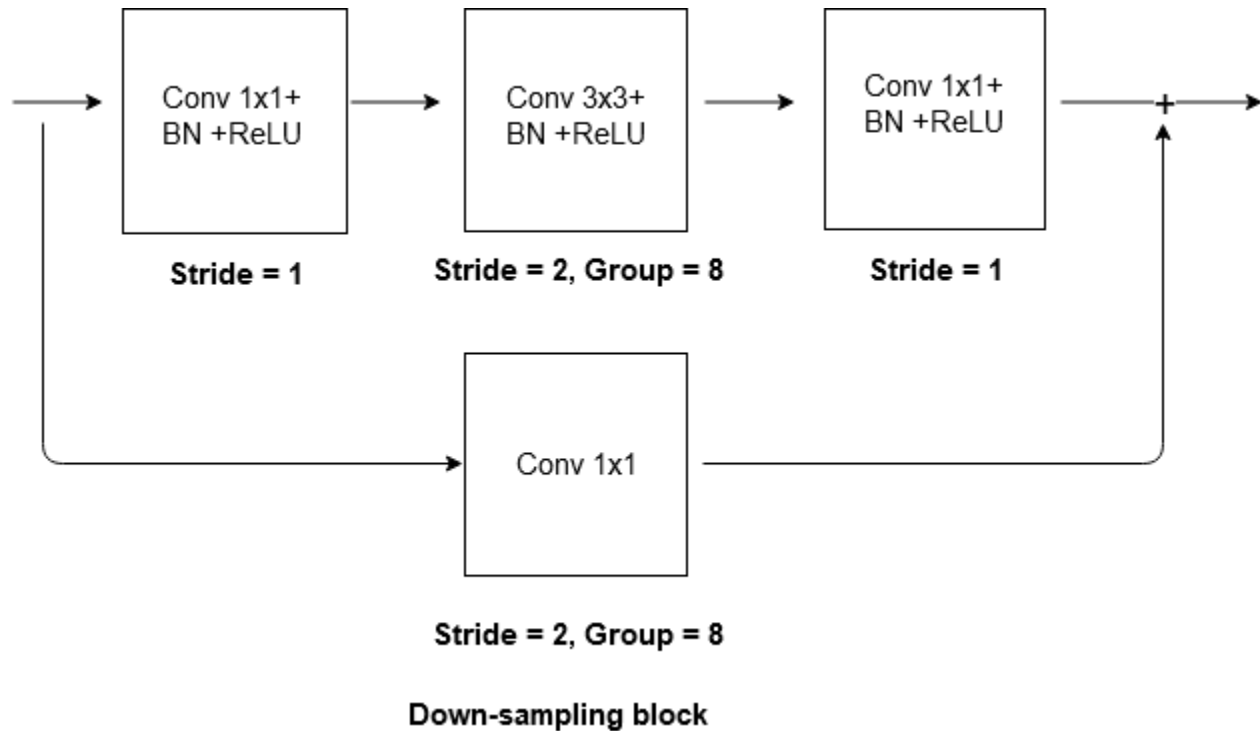
        1. The network structure

        2. The network standard building block

Normal building block

3. The network down sampling building block

Down-sampling block

b) **Include 1 table**
   1. Describes the parameters (e.g., channels, groups, repeats, …) to create RegNetX-200MF from the generic network structure, standard building block and down sampling building block

| Layer name	Output size	Stride	RegNetX-200MF
stem	56x56	1	3x3,24, s=1
enc_0 (Layer 0, depth=1, channel=24)	56x56	1	1x1,24, s=1 3x3,24, s=1, g=8 1x1,24, s=1
enc_1 (Layer1, depth=1, channel=56)	28x28	2	1x1,24, s=1 3x3,24, s=2, g=8 1x1,56, s=1
enc_2 (Layer2, depth=4, channel=152)	14x14	2	1x1,56, s=1 3x3,56, s=2, g=8 ⎫ x4 1x1,152, s=1 ⎭
enc_3 (Layer3, depth=7, channel=368)	7x7	2	1x1,152, s=1 3x3,152, s=2, g=8 ⎫ x7 1x1,368, s=1 ⎭
dec (Head)	1x1	-	AvgPool, 100-d fc, Softmax

Section 2 – Training

a.) Include 1 table

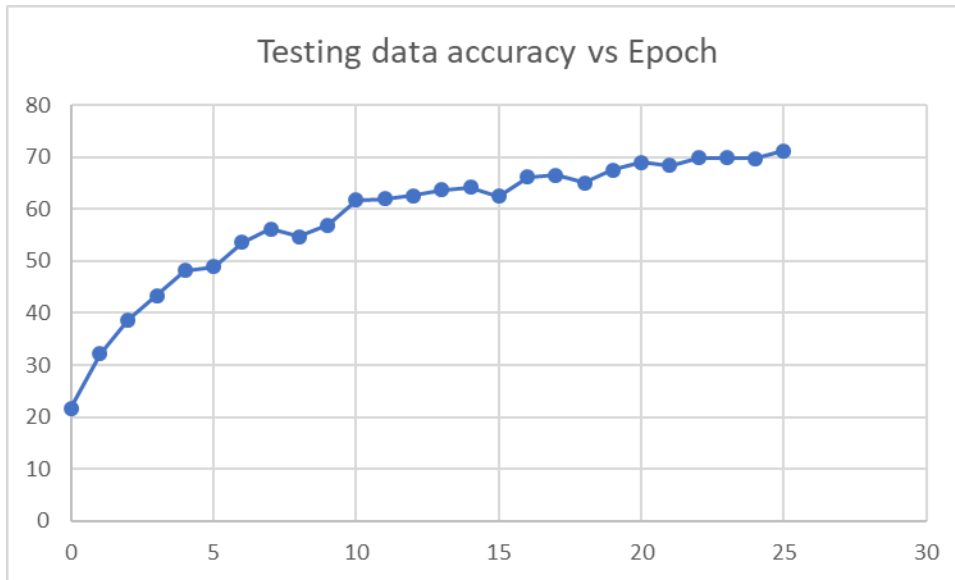   (1) All hyper parameters and associated values

DATA_BATCH_SIZE	256
DATA_MEAN	(0.485, 0.456, 0.406)
DATA_STD_DEV	(0.229, 0.224, 0.225)
SEED	42
TRAINING_LR_MAX	0.01
TRAINING_LR_INIT_SCALE	0.1
TRAINING_LR_INIT_EPOCHS	3
TRAINING_LR_FINAL_SCALE	0.1
TRAINING_LR_FINAL_EPOCHS	23
TRAINING_NUM_EPOCHS	3+23 = 26
TRAINING_LR_INIT	0.01*0.1 = 0.001
TRAINING_LR_FINAL	0.01*0.1 = 0.001
optimizer	Adam
optimizer betas	0.9, 0.999
optimizer eps	1e-08
optimizer weight_decay	0

b.) Include 2 plots

    1.   Training data loss vs epoch
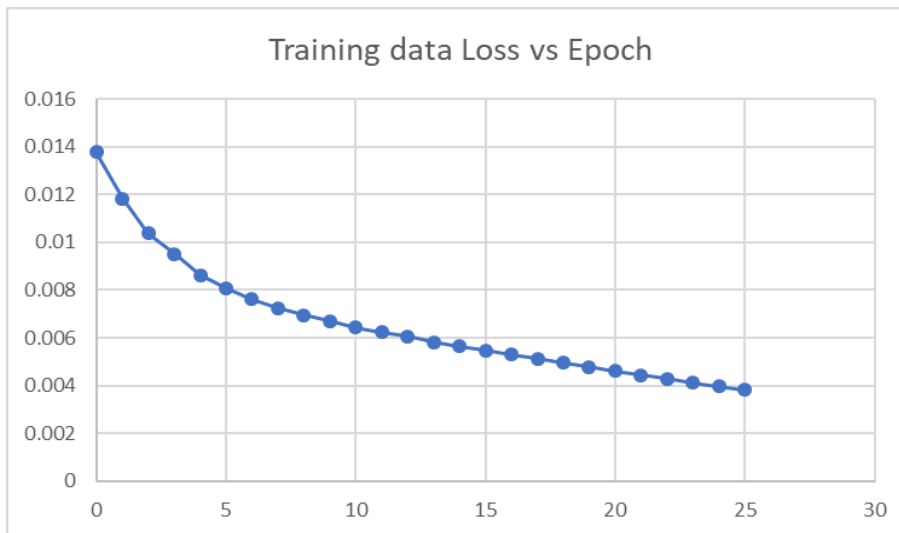
    2.   Testing data accuracy vs epoch

3. List the final accuracy
71.24%

Section 3 – Implementation
a.) Include 1 table

1. A list of each CNN style 2D convolution operator and associated the number of MACs and parameters; at the bottom of the table put a sum for the whole network

Layer	Parameters	Input	Output	MAC
stem	648	3x56x56	24x56x56	2,032,128
enc_0.0 – conv1	576	24x56x56	24x56x56	1,806,336
enc_0.0 – conv2 (G=8, S=1)	648	24x56x56	24x56x56	2,032,128
enc_0.0 – conv3	576	24x56x56	24x56x56	1,806,336
enc_1.0 – conv0 (G=8, S=2)	168	24x56x56	56x28x28	131,712
enc_1.0 – conv1	576	24x56x56	24x56x56	1,806,336
enc_1.0 – conv2(G=8, S=2)	648	24x56x56	24x28x28	508,032
enc_1.0 – conv3	1344	24x28x28	56x28x28	1,053,696
enc_2.0 – conv0(G=8, S=2)	1064	56x28x28	152x14x14	208,544
enc_2.0 – conv1	3136	56x28x28	56x28x28	2,458,624
enc_2.0 – conv2(G=8, S=2)	3528	56x28x28	56x14x14	691,488
enc_2.0 – conv3	8512	56x14x14	152x14x14	1,668,352

enc_2.1 – conv1	23104	152x14x14	152x14x14	4,528,384
enc_2.1 – conv2(G=8, S=1)	25992	152x14x14	152x14x14	5,094,432
enc_2.1 – conv3	23104	152x14x14	152x14x14	4,528,384
enc_2.2 – conv1	23104	152x14x14	152x14x14	4,528,384
enc_2.2 – conv2(G=8, S=1)	25992	152x14x14	152x14x14	5,094,432
enc_2.2 – conv3	23104	152x14x14	152x14x14	4,528,384
enc_2.3 – conv1	23104	152x14x14	152x14x14	4,528,384
enc_2.3 – conv2(G=8, S=1)	25992	152x14x14	152x14x14	5,094,432
enc_2.3 – conv3	23104	152x14x14	152x14x14	4,528,384
enc_3.0 – conv0(G=8, S=2)	6992	152x14x14	368x7x7	342,608
enc_3.0 – conv1	23104	152x14x14	152x14x14	4,528,384
enc_3.0 – conv2(G=8, S=2)	25992	152x14x14	152x7x7	1,273,608
enc_3.0 – conv3	55936	152x7x7	368x7x7	2,740,864
enc_3.1 – conv1	135424	368x7x7	368x7x7	6,635,776
enc_3.1 – conv2(G=8, S=1)	152352	368x7x7	368x7x7	7,465,248
enc_3.1 – conv3	135424	368x7x7	368x7x7	6,635,776
enc_3.2 – conv1	135424	368x7x7	368x7x7	6,635,776
enc_3.2 – conv2(G=8, S=1)	152352	368x7x7	368x7x7	7,465,248
enc_3.2 – conv3	135424	368x7x7	368x7x7	6,635,776
enc_3.3 – conv1	135424	368x7x7	368x7x7	6,635,776
enc_3.3 – conv2(G=8, S=1)	152352	368x7x7	368x7x7	7,465,248
enc_3.3 – conv3	135424	368x7x7	368x7x7	6,635,776
enc_3.4– conv1	135424	368x7x7	368x7x7	6,635,776
enc_3.4 – conv2(G=8, S=1)	152352	368x7x7	368x7x7	7,465,248
enc_3.4 – conv3	135424	368x7x7	368x7x7	6,635,776
enc_3.5 – conv1	135424	368x7x7	368x7x7	6,635,776
enc_3.5 – conv2(G=8, S=1)	152352	368x7x7	368x7x7	7,465,248
enc_3.5 – conv3	135424	368x7x7	368x7x7	6,635,776
enc_3.6 – conv1	135424	368x7x7	368x7x7	6,635,776
enc_3.6 – conv2(G=8, S=1)	152352	368x7x7	368x7x7	7,465,248
enc_3.6 – conv3	135424	368x7x7	368x7x7	6,635,776
dec	36800	368x7x7	368x1x1	135,424
Total	2926048			7,676,928 + 3,499,776+ 47,480,608 + 133,441,688 = 192,099,000