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Question 1. Fill in the Blanks (input shape, output shape, and the number of learning parameters for each layer).
Make sure you show all the steps on paper.

layer	Input Channel	Filter	Output Channel	Str.	Pooling	activation function	Input	Output	Parameter
Conv. Layer 1	1	(4, 4)	20	1	X	relu	(39,31,1)	36, 28, 20	2016
Pooling L1	20	X	20	2	(2, 2)	X	36, 28, 20	18, 14, 20	5040
Conv. Layer 2	20	(3, 3)	40	1	X	relu	18, 14, 20	16, 12, 40	7680
Pooling L2	40	X	40	2	(2, 2)	X	16, 12, 40	8, 6, 40	1920
Conv. Layer 3	40	(3, 3)	60	1	1	relu	8, 6, 40	6, 4, 60	1440
Pooling L3	60	X	60	2	(2, 2)	X	6, 4, 60	3, 2, 60	360
Conv. Layer 4	60	(2, 2)	80	1	1	relu	3, 2, 60	2, 1, 80	160
Flatten	X	X	X	X	X	X			
fully connected Layer	X	X	X	X	X	softmax			

Question 2.

Full (simplified) AlexNet architecture :

[227 × 227 × 3 images] INPUT
[? × ? × ? images] CONV1 : 96 11 × 11× 3 Filters at stride 4, pad 0
[? × ? × ? images] MAX POOL1 : 3 × 3 × 3 Filters at stride 2
[27 × 27 × 96 images] NORM1 : Normalization layer
[? × ? × ? images] CONV2 : 256 5 × 5 Filters at stride 1, pad 2
[? × ? × ? images] MAX POOL2 : 3 × 3 Filters at stride 2
[13 × 13 × 256 images] NORM2 : Normalization layer
[? × ? × ? images] CONV3 : 384 3 × 3 Filters at stride 1, pad 1
[? × ? × ? images] CONV4 : 384 3 × 3 Filters at stride 1, pad 1
[? × ? × ? images] CONV5 : 256 3 × 3 Filters at stride 1, pad 1
[? × ? × ? images] MAX POOL3 : 3 × 3 Filters at stride 2
[4096] FC6 : 4096 neurons
[4096] FC7 : 4096 neurons
[1000] FC8 : 1000 neurons (class scores)

1) Height $= \frac{H+2p-fH}{S}+1 = \frac{39-4}{1}+1 = \frac{35+1}{36}$, 36

Width $= \frac{W+2p-fW}{S}+1 = \frac{31-4}{1}+1 = \frac{27+1}{28}$, 28. (36, 28, 20)

= 20 LKD.

2) $\frac{36-2}{2}+1 = 18$, $\frac{28-2}{2}+1 = 14$ output : 20 (18, 14, 20) = 5040.

3) $\frac{18-3}{1}+1 = 16$, $\frac{14-3}{1}+1 = 12$ output: 40 (16, 12, 40) = 7680

4) $\frac{16-2}{2}+1 = 8$ $\frac{12-2}{2}+1 = 6$ output = 40 (8, 6, 40) = 1920

5) $\frac{8-3}{1}+ = 6$ $\frac{6-3}{1}+1 = 4$ output = 60 (6, 4, 60) = 1440

6) $\frac{6-2}{2}+1 = 3$ $\frac{4-2}{2} = 1 = 2$ output 60 (3, 2, 60) = 360

7) $\frac{3-2}{1}+1 = 2$ $\frac{2-2}{1}+1 = 1$ output 80 (2, 1, 80) = 160

Question-2 :

227 x 227 x 3. output: $\frac{227-11}{4}+1 = 55$.

output (55, 55, 96) $w = \frac{227-11}{4}+1 = 55$.

① output = (27, 27, 96) $h = \frac{55-3}{2}+1 = 27$., $w = \frac{55-3}{2}+1 = 27$.

pool-3. output = (27, 27, 256) $h = \frac{27+2\times1-5}{1}+1 = 27$. $w = \frac{27\times2\times1-5}{1}+1 = 27$.

3 output = (13, 13, 256) $h = \frac{27-3}{2}+1 = 13$ $w = \frac{27-3}{2}+1 = 13$.

conv 4 (13, 13, 384) $= h = \frac{13+2-3}{1}+1 = 13$ $w = \frac{13+2-3}{1} = 13$.

conv5 output (13, 13, 256) $h = \frac{13+2-3}{1}+1 = 13$ $w = \frac{13+2-3}{1} = 13$

pool 3 (6, 6, 256) $h = \frac{13-3}{2}+1 = 6$ $w = \frac{13-3}{2}+1 = 6$.