Course Title: Artificial Intelligence Date : 29 / 05 / 2019 No. of Questions: 4 Questions Time: 2 hour Using Calculator (Yes)	Final Exam 2018/2019 Total Grade:60	Instructor Name: Dr. Mohammed El Astal Student No.: Student Name: College Name: Dep. / Specialist: Using Dictionary (No)
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QUESTION I: Basics of Artificial Neural Networks (10 Marks)

I.1: Choose the correct answer:

1. Given that your problem is to design, an "admission predictor" for Harvard University based on 1) test's score, 2) tawjihi's score, and 3) class rank, which are true?

	· · · · · · · · · · · · · · · · · · ·	
	a) The input layer is of size 3	b) The output layer is of size 1
	c) a & b	d) none of the above
2.	For the problem in (1), which activation func	tion can be used for the output layer
	a) Step function	b) Sigmoid function
	c) Softmax function	d) all of the above
3.	Given Score = $2 \times \text{Test} + \text{Grade} + \text{Rank} - b$, where $\text{Rank} - $	at is the minimum value of bias that let the student who
	got 7 on the test, 6 on the grades and 3 on th	e rank would be rejected?
	a) 6 b) 11	c) 24 d) 21
4.	Which one is activation function?	
	a) Hyperbolic Tangent Function	b) Sigmoid function
	c) ReLu function	d) all of the above

5. Overfitting problem can be avoided by

a) Early Stopping	b) Dropout
c) a & b	d) none of the above

I.2: Determine neurons' outputs y_1 , y_2 , y_3 , z_1 , and z_2 if the input to the network is $x = [1, 0, 2]^T$? Assume all neurons have sigmoid activation functions, a bias that is equal to 0, and the following weight vectors are obtained, $v_{11} = 0.5$, $v_{12} = 0.3$, $v_{21} = 1$, $v_{22} = -1$, $v_{23} = 2$, $v_{31} = 0.6$, $v_{32} = 0.4$, $v_{33} = 0.5$. $w_{11} = 0.2$, $w_{12} = 0.8$, $w_{21} = 2$, $w_{31} = 0.4$. $\sigma(x) = \frac{1}{1+e^{-x}}$



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QUESTION II: Basics of Convolutional Neural Networks (10 Marks)

II.1: Choose the correct answer:

- 1. Given that your problem is to design, an "object detector" for animals based on COCO dataset, which has images each is with a resolution of 28×28×1 and 12 animal categories, which are true?
 - a) The input layer is of size 784b) The output layer is of size 12c) Soft-max function should be usedd) all of the above

c) ResNet

- 2. For the problem in (1), what is the output's image size if a convolutional layer with stride=2 and a **max-pooling** layer with stride 2 is applied.
- a) $14 \times 14 \times k$ b) $56 \times 56 \times k$ c) $7 \times 7 \times k$ d) $112 \times 112 \times k$ 3. Which of the following consider a groundbreaking CNN architecture?

d) all of the above

4. For the following part of image, compute the output of each step assuming zero padding.

b) VGG16/19

	Input	imag	e]	Norm	alized		Fi	lter (R)	Fi	lter-oı	itput (R)]	Max	pool
0	0	102	102					0	-1	0							
0	255	0	0					-1	4	-1							
0	0	0	102					0	-1	0							
0	102	255	0							•							

II.2: The CNN Architecture:

a) AlexNet

Using the code structure shown, define CNN class by completing the following code as described below:

code	Question
<pre>class Net(nn.Module): definit(self): super(Net, self)init() # convolutional layer (sees 32x32x3 image tensor) self.conv1 = nn.Conv2d(3, 16, 3, padding=1) self.pool = nn.MaxPool2d(2, 2) self.fol = nn.Linear(64 * 4 * 4, 500)</pre>	 Define 3 convolutional layers, with output filter of 16, 32, 64 size. (the first layer is already included for you)
sen.ici = nn.Linear(04 * 4 * 4, 500)	 Define a linear layer, with 10 outputs. Define dropout layer, with 0.25 dropping probability.

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QUESTION III: Style Transfer using CNN (20 Marks)

III.1: Choose the correct answer:

1.	Feature-level representations of CNN are useful/used	for
	a) image/object classification	b) style transfer
	c) deep dream	d) all of the above
2.	Style Transfer allows you to apply the style of one im	age to the another image using
	a) Pre-trained neural network	b) VGG19
	c) None of the above	d) a & b
3.	Generally in CNN, the image is transformed into feature	re-maps which care about content
	of image rather than details like texture & colors.	-
	a) at the first convolutional layer	b) as we go deeper
	c) at the first linear layer	d) none of the above
4.	In style-transfer using CNN, the content representation	is taken fromlayer of VGG19
	a) conv2_1 b) conv4_2	c) conv1_1 d) conv3_1
5.	In style-transfer, the target is to	
	a) minimize a defined loss function between our	b) train the VGG network by
	target & content image	backpropagation
	c) update weights of VGG19 until loss minimized	d) all of the above
III	2. Correlation & Gram matrix.	

In style transfer, the extraction of image's style is determined based on correlation between features in individual layers of VGG19. The correlation is claculated based on gram matrix. Assuming that the input image 4*4 is convolved with 4 filters and the resultant images are given below; compute the gram matrix

Fil	ter1's	s outp	out
0	1	0	0.3
0	0	0	0
1	0.3	0	0
0	0.3	0	0

Filter2's output								
0	0	1	1					
0	0.4	0	0.4					
0	0.4	0	0					
0	0	0	0					

Filter3's output								
0	0	0	0					
1	0	0	0.1					
0	0.1	0	0					
0	0	0.1	0					

Filter4's output					
0	0	0	0.4		
0	0	1	0		
0	0.4	0	0		
0	0	0	0		

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b) doesn't has enough memory size

QUESTION IV: Basics of Recurrent Neural Networks (20 Marks)

IV.1: Choose the correct answer:

- 1. The traditional RNN architecture experiences a short-memory drawback, this is due to
 - a) vanishing gradient occurs
 - c) can't handle very small number results of gradient d) a & c
- 2. In LSTM, the remember gate
 - a) forgets everything that it doesn't consider useful
 - b) joins the event occur and the short-term memory updated.
 - c) joins the long-term memory that we've updated & the new information that we've learned
 - d) it takes the long-term memory and the new information to decide what to output
- 3. At event *t*, the prediction (output) and LTM & STM is determined based on

a) LTM_{t+1} , STM_{t+1} event _{t+1}	b) LTM_{t-1} , STM_{t-1} event _{t-1}
c) a & b	d) none of the above

4. In LSTM, the learn gate includes.....

e) combine & ignore	f) forget & combine	g) use & combine	h) none of the above
stages	stages	stages	

5. In style-transfer, the target is to

e) minimize a defined loss function between our		train	the	VGG	network	by
target & content image		backpropagation				
g) update weights of VGG19 until loss minimized	h)	all of t	he above			

IV.2: Correlation & Gram matrix:

Draw the detaild LSTM architecture with Peephole connection? Showing sigmoid & tanh function used

