

# Nanoquiz Week 11

The questions below are due on Thursday April 26, 2018; 09:50:00 AM.

## Nanoquiz Instructions

Nanoquizzes are just like any other tutor exercise, except that they are timed, and that some questions allow a limited number of submissions. When the timer hits zero, you will be prevented from making any further submissions to the nanoquiz, and the answers will be displayed, so **please make sure you have submitted something before that occurs**.

Note that you are free to use any materials you want (electronic or otherwise, including notes, calculators, Python, and Wikipedia) during the nanoquiz, but you are **not** allowed to converse with other humans (including through text message, email, etc).

## Nanoquiz

We will use an RNN to predict  $y_t$ , which we know is a decaying sum of the inputs  $x_t$  (which are numbers) with decay rate  $\gamma$  between 0 and 1:

$$y_t = \sum_{i=0}^t \gamma^{t-i} x_i$$

We will use an RNN of the following form:

$$\begin{aligned} s_t &= f_1(W^{sx}x_t + W^{ss}s_{t-1}) \\ y_t &= f_2(W^os_t) \end{aligned}$$

where  $f_1$  and  $f_2$  are two activation functions, and the  $x_t$  can be treated as 1x1 arrays. The output are numbers  $y_t$ .

Throughout this question, assume  $x_t = 0$  for all  $t < 0$ .

1) Assuming  $\gamma = 0.9$ , what are the values of  $[y_0, y_1, y_2]$  given  $[x_0, x_1, x_2] = [1, 0, 2]$ .

Enter a list of three numbers:

Save

Submit

View Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:  
*You have infinitely many submissions remaining.*

2) Conveniently, the definition of  $y_t$  can be rewritten in a recursive form, if we assume  $y_t = 0$  for  $t < 0$ . Which of the following is correct?

Pick one:

☐  $y_t = \gamma y_{t-1} x_t$

☐  $y_t = \gamma y_{t-1} + x_t$

☐  $y_t = y_{t-1} + \gamma x_t$

☐  $y_t = y_{t-1} + \sum_{i=1}^t x_i \gamma^{t-i}$

Save

Submit

View Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

*You have infinitely many submissions remaining.*

3) What is the best choice for  $f_1$ ?

Pick one: 

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Save

Submit

View Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

*You have infinitely many submissions remaining.*

4) What is the best choice for  $f_2$ ?

Pick one: 

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Save

Submit

View Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

*You have infinitely many submissions remaining.*

5) What is the smallest dimensionality for the state  $s$  that will allow this function to be implemented exactly?

Enter a single number:

Save

Submit

View Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

*You have infinitely many submissions remaining.*

6) Provide matrices  $W^{s,x}$ ,  $W^{s,s}$ ,  $W^o$  (in that order) that implement this model (assuming  $\gamma = 0.9$ ). Assume that the initial state is a column vector of 0's.

You will need to enter a list of three matrices, each matrix as a list of **rows**, each row is also a list. **If the answer were** three 2x2 matrices, you would enter something like this.

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[ [ [ a, b], [c, d] ], [ [e, f], [g, h] ], [ [i, j], [k, l] ] ]
```

Enter a list of matrices:

Save

Submit

View Answer

100.00%

As staff, you are always allowed to submit. If you were a student, you would see the following:  
*You have infinitely many submissions remaining.*