

WEEK 2 QUIZ

Optimization algorithms

TOTAL POINTS 10

1. Which notation would you use to denote the 3rd layer's activations when the input is the 7th example from the 8th minibatch?

☐ $a^{[8]\{3\}}(7)$

☒ $a^{[3]\{8\}}(7)$

☐ $a^{[3]\{7\}}(8)$

☐ $a^{[8]\{7\}}(3)$

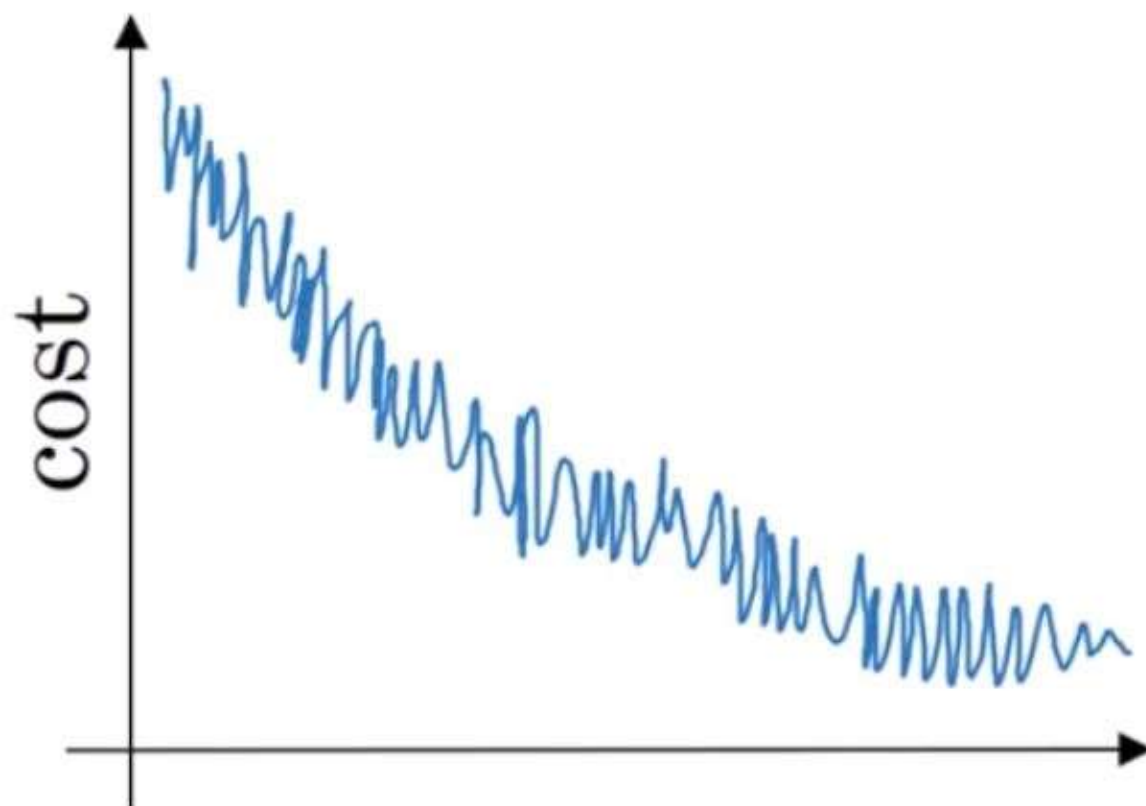
2. Which of these statements about mini-batch gradient descent do you agree with?

- ☐ Training one epoch (one pass through the training set) using mini-batch gradient descent is faster than training one epoch using batch gradient descent.
- ☒ One iteration of mini-batch gradient descent (computing on a single mini-batch) is faster than one iteration of batch gradient descent.
- ☐ You should implement mini-batch gradient descent without an explicit for-loop over different mini-batches, so that the algorithm processes all mini-batches at the same time (vectorization).

3. Why is the best mini-batch size usually not 1 and not m , but instead something in-between?

- ☐ If the mini-batch size is 1, you end up having to process the entire training set before making any progress.
- ☐ If the mini-batch size is m , you end up with stochastic gradient descent, which is usually slower than mini-batch gradient descent.
- ☒ If the mini-batch size is 1, you lose the benefits of vectorization across examples in the mini-batch.
- ☒ If the mini-batch size is m , you end up with batch gradient descent, which has to process the whole training set before making progress.

4. Suppose your learning algorithm's cost J , plotted as a function of the number of iterations, looks like this:



Which of the following do you agree with?

- ☐ If you're using mini-batch gradient descent, something is wrong. But if you're using batch gradient descent, this looks acceptable.
- ☐ Whether you're using batch gradient descent or mini-batch gradient descent, this looks acceptable.
- ☒ If you're using mini-batch gradient descent, this looks acceptable. But if you're using batch gradient descent, something is wrong.
- ☐ Whether you're using batch gradient descent or mini-batch gradient descent, something is wrong.

5. Suppose the temperature in Casablanca over the first three days of January are the same:

Jan 1st: $\theta_1 = 10^\circ C$

Jan 2nd: $\theta_2 = 10^\circ C$

(We used Fahrenheit in lecture, so will use Celsius here in honor of the metric world.)

Say you use an exponentially weighted average with $\beta = 0.5$ to track the temperature: $v_0 = 0$, $v_t = \beta v_{t-1} + (1 - \beta)\theta_t$. If v_2 is the value computed after day 2 without bias correction, and $v_2^{\text{corrected}}$ is the value you compute with bias correction. What are these values? (You might be able to do this without a calculator, but you don't actually need one. Remember what is bias correction doing.)

- ☐ $v_2 = 10, v_2^{\text{corrected}} = 10$
- ☐ $v_2 = 10, v_2^{\text{corrected}} = 7.5$
- ☐ $v_2 = 7.5, v_2^{\text{corrected}} = 7.5$
- ☒ $v_2 = 7.5, v_2^{\text{corrected}} = 10$

6. Which of these is NOT a good learning rate decay scheme? Here, t is the epoch number.

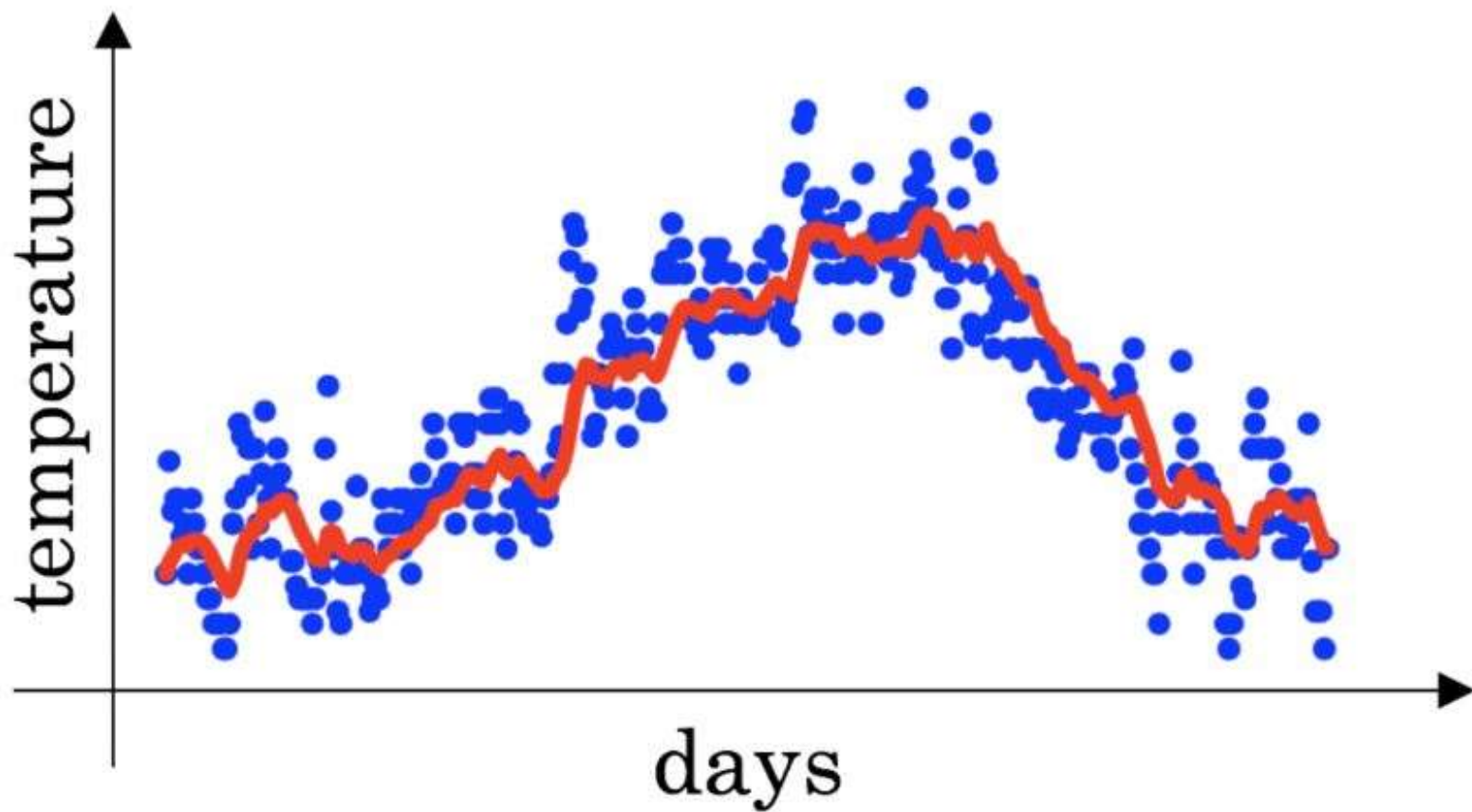
☐ $\alpha = \frac{1}{1+2*t} \alpha_0$

☐ $\alpha = 0.95^t \alpha_0$

☒ $\alpha = e^t \alpha_0$

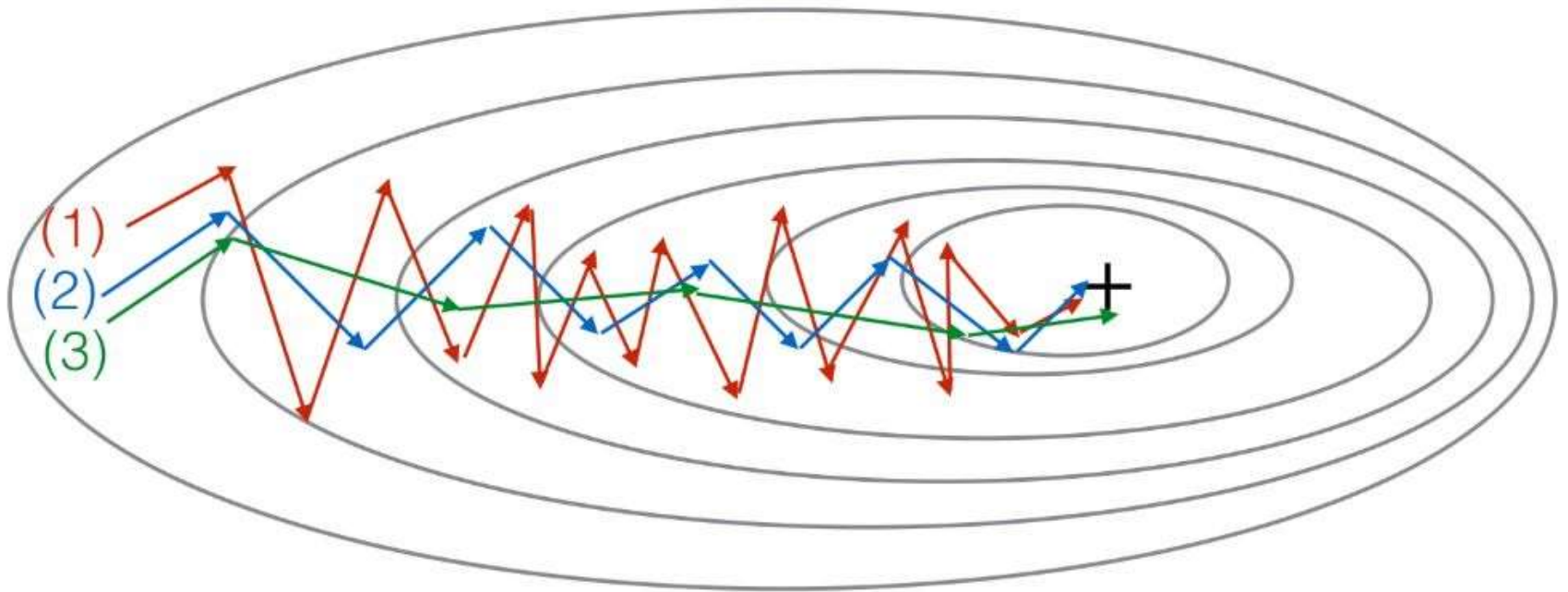
☐ $\alpha = \frac{1}{\sqrt{t}} \alpha_0$

7. You use an exponentially weighted average on the London temperature dataset. You use the following to track the temperature: $v_t = \beta v_{t-1} + (1 - \beta)\theta_t$. The red line below was computed using $\beta = 0.9$. What would happen to your red curve as you vary β ? (Check the two that apply)



- ☐ Decreasing β will shift the red line slightly to the right.
- ☒ Increasing β will shift the red line slightly to the right.
- ☒ Decreasing β will create more oscillation within the red line.
- ☐ Increasing β will create more oscillations within the red line.

8. Consider this figure:



These plots were generated with gradient descent; with gradient descent with momentum ($\beta = 0.5$) and gradient descent with momentum ($\beta = 0.9$). Which curve corresponds to which algorithm?

- ☐ (1) is gradient descent. (2) is gradient descent with momentum (large β) . (3) is gradient descent with momentum (small β)
- ☐ (1) is gradient descent with momentum (small β). (2) is gradient descent. (3) is gradient descent with momentum (large β)
- ☒ (1) is gradient descent. (2) is gradient descent with momentum (small β). (3) is gradient descent with momentum (large β)
- ☐ (1) is gradient descent with momentum (small β), (2) is gradient descent with momentum (small β), (3) is gradient descent

9. Suppose batch gradient descent in a deep network is taking excessively long to find a value of the parameters that achieves a small value for the cost function $\mathcal{J}(W^{[1]}, b^{[1]}, \dots, W^{[L]}, b^{[L]})$. Which of the following techniques could help find parameter values that attain a small value for \mathcal{J} ? (Check all that apply)

- ☒ Try using Adam
- ☒ Try mini-batch gradient descent
- ☒ Try better random initialization for the weights
- ☐ Try initializing all the weights to zero
- ☒ Try tuning the learning rate α

10. Which of the following statements about Adam is False?

- ☐ We usually use "default" values for the hyperparameters β_1, β_2 and ε in Adam ($\beta_1 = 0.9, \beta_2 = 0.999, \varepsilon = 10^{-8}$)
- ☐ The learning rate hyperparameter α in Adam usually needs to be tuned.
- ☐ Adam combines the advantages of RMSProp and momentum
- ☒ Adam should be used with batch gradient computations, not with mini-batches.