Neural Networks exam topics

1. Topic
   a. Local optimization in non-convex cases (reason for non-convexity?)
   b. RMSP optimizer
   c. Dropout
   d. ResNet
   e. Gradient ascent
2. Topic
   a. Weight update strategies
   b. ReLU and the dying ReLU problem
   c. LSTM cell
   d. Convolution as a mathematical operation in continuous and discrete cases
3. Topic
   a. Newton optimization method
   b. Ensembling, bagging
   c. Comparison of loss functions
   d. Machine learning vs. traditional programming
   e. Inception
4. Topic
   a. McCulloch-Pitts model
   b. Parameters of convolution - filter, stride, padding, etc.
   c. Linear classifier, margin of the classifier
   d. Data augmentation
   e. YOLO
5. Topic
   a. Statistical learning theory
   b. Various activation functions and their properties
   c. Autoencoders
   d. Graph unrolling and parameter sharing in recurrent neural networks
   e. MobileNet
6. Topic
   a. Machine learning problem definition
   b. Newton optimizer
   c. Effects and relationship of model capacity and complexity - overfitting, underfitting
   d. t-Distributed Stochastic Neighbor Embedding
   e. ShuffleNet
7. Topic
   a. Credit approval problem
   b. Objective functions in neural networks
   c. Nesterov momentum optimizer
   d. Decomposition of convolutional kernels
   e. Alexnet + ILSVRC

8. Topic
    a. Delta learning rule
    b. Batch normalization
    c. Transposed convolution, atrous convolution
    d. Object classification + localization vs. object detection vs. semantic segmentation vs. instance segmentation
    e. ResNext
9. Topic
    a. ADAM optimizer
    b. The softmax function
    c. R-CNN architectures - R-CNN, Fast R-CNN, Faster R-CNN
    d. Supervised vs. unsupervised learning
    e. EfficientNet
10. Topic
    a. Optimization problem of objective functions of neural networks
    b. AdaGrad optimizer
    c. Input vector normalization
    d. DeconvNet, U-Net
    e. Neural style transfer
11. Topic
    a. Multilayer perceptron
    b. Early stopping
    c. Gradient descent (multidimensional cases as well)
    d. Weight regularization (L1, L2)
    e. Pooling
12. Topic
    a. Perceptron convergence theorem - no proof required
    b. Momentum optimizer
    c. Properties of convolutional neural networks - sparsity, parameter sharing, equivariance, invariance to shifting
    d. Recurrent neural network examples: predicting the next letter, image captioning
    e. Adversarial attacks
13. Topic
    a. Elementary set separation by a single neuron
    b. Local response normalization
    c. Unpooling
    d. Representations - Blum and Li theorem, construction
14. Topic
    a. Principal component analysis (PCA)
    b. Back-propagation through time
    c. Stochastic gradient descent optimizer
    d. Object detection problem explained
    e. Effects of filter size on convolution
15. Topic
    a. Rosenblatt perceptron training algorithm

b.   Back-propagation
c.   Curse of dimensionality
d.   SqueezeNet
e.   Backpropagation and gradient-based optimizers