**Questions (50 points)**

Answer each of these questions with 1 – 5 sentences.

1. Which are the major types of disorders of the nervous system? Is there any overlap between these types? (8 pts)
2. List some types of treatment approaches that exist for treating disorders of the nervous system (6 pts)
3. Are the effects of physical and psychological interventions fully separable? (4 pts)
4. Which are the most common animal models in clinical neuroscience, and why? (6 pts)
5. Give some reasons why animal models are used in clinical neuroscience. (6 pts)
6. Name one neurological condition in which surgery on the human brain sometimes becomes necessary. (2 pts)
7. Which are the main components of neurons? (3 pts)
8. What is the function of afferent and efferent nerves? (5 pts)
9. Which are the ‘classical’ four lobes of the cortex? Which regions are sometimes regarded as separate lobes? (6 pts)
10. Which are 3 common approaches to identify clinical relevance of brain regions? Which of these is the oldest? (4 pts)

**Python exercises (50 points + 8 bonus points)**

These exercises can be carried out in python with just the packages numpy, scipy, matplotlib. You can also use pandas and seaborn for some tasks if you want. If you can’t do them on a desktop or laptop, it should be possible also to do them online in Jupyterlab or Colab.

Bonus points go towards completion of this exercise and do not count as special assignment. If you get 100 or more points for this exercise, 100% is entered as your result.

Imagine that we performed a neuroimaging experiment in which we recorded a total of 80 subjects in two cohorts: 40 patients and 40 healthy controls. We recorded some observable called ‘brain activity’ in 100 regions – called ‘parcels’ – of the cortex.

1. Load the csv files ‘patient\_data.csv’ and ‘controls\_data.csv’ into numpy arrays. These arrays give you the mean brain activity for each parcel for each subject, during the experiment.
2. Use independent-sample t-tests to compare the brain activity between patients and controls in each of the parcels. Save the test statistics and p-values to arrays. In how many parcels is there a significant difference (p < 0.05) between the two cohorts? In how many of these is the activity larger in patients? (7 pts)
3. Load the ‘parcel\_names.txt’ file. You will see from the parcel names that the parcels have been assigned to 7 different functional systems or ‘networks’. Create for each network a list of indices with those parcels that belong to this network. How many parcels are in each network? (4 pts)
4. Compute for each subject the mean brain activity in each network. Now compare for each network with t-tests the brain activity between patients and controls. In which networks is the brain activity significantly larger/smaller in patients? (7 pts)
5. On a single figure, plot the mean brain activity per network in each cohort in an informative way (6 pts).

4b. Show also the standard deviation for each network in the above plot. (2 bonus points)

4c. Plot the distribution of subjects’ activity per network in violinplots. (3 bonus points)

1. Load the patients’ symptom scores from ‘symptom\_scores.txt’ and plot them in a histogram with 20 bins. (4 pts)
2. For each parcel, compute the Spearman correlation between symptom score and brain activity in the patient group. In how many parcels is the correlation significant? In which network are most significant correlations? (8 pts)
3. Compute the correlation with scores at the network level (network mean with score). For which networks is the correlation significant? (6 pts)
4. For each of the significantly correlated networks, plot symptom scores and the network’s mean brain activity in a scatterplot and label both axes. (8 pts)

8b. Add a linear fit to each of the scatterplots. (3 bonus points)