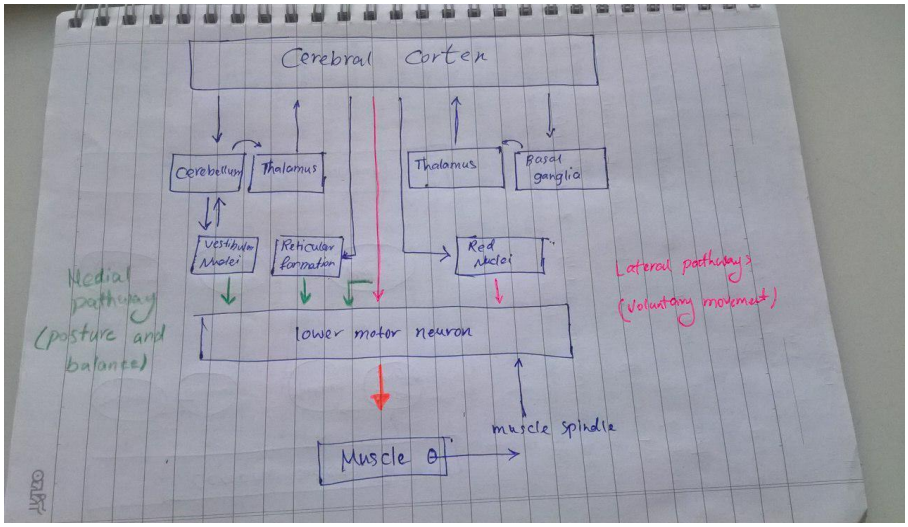
First week, AC 2

Question1.



Question 2.

Two types of motor control that control our movements are feedforward control and feedback control. Feedforward control (open loop), require a world modal to store predictions and use the prediction to generate an action. Since it involves no iteration (open loop), It is fast. This type of motor control is error-prone. Moreover, it requires learning in how to react to a stimulus. For example, when a ball is thrown toward you, feedforward motor control system predicts it and prepares to catch the ball.

On the other hand, feedback control (close loop) compares the actual state with a desired state and if there is a mismatch between them it sends an error signal to correct the movement. Since achieving goal state may take some iteration, this system is rather slow. In the previous example, if the ball is heavier than what we predicted, the feedback control will send an error signal to adjust the limb position. Moreover, this types of motor control requires no learning. All in all, feedforward and feedback control are not mutually exclusively, both system interact with each other.

Question 3.

In general, central nervous system (CNS) motor pathway includes two main pathway of motor neurons: lower motor neurons and upper motor neurons.

Lower motor neurons are the neurons whose cell bodies reside in brain stem or spinal cord and their axons project to striated muscles. Lower motor pathway is a final pathway for muscle activation. Thus, lesion of a lower motor neurons has many consequences. Muscles no loner excited and they become paralyzed and flaccid, so a person is not able to move its muscles and the muscles tone will decrease. Due to the fact that cell bodies of the lower motor neurons reside in spinal cord and they don't receive information, all reflexes disappear (areflexia) and eventually it leads to muscle atrophy which is decrease in the mass of the muscle. In conclusion, severity of the symptoms mostly depends on the location of the lesion, and the lesion affects Individual muscles rather than groups of muscles.

Question 4.

In general, central nervous system (CNS) motor pathway includes two main pathway of motor neurons: lower motor neurons and upper motor neurons. Upper motor neurons are the neurons whose cell bodies reside at higher levels in the central nervous system (CNS) and their axons project to the lower motor neurons. Lesion to upper motor neurons affects groups of muscles and at the beginning, it leads to spinal shock which means loss of reflexes (areflexia) and reduction in muscle tone. However, after few days or weeks reflexes return even stronger (hyperreflexia) and muscle tone increases again and limbs become spastic. Moreover, if the lesion occurs on one side of the body lead to hemiplegia. All in all, upper motor neuron lesion leaves the reflexes pathway intact, but it has many consequences.

Question 5.

The spinal cord provides a basis for reflexes which are involuntary, stereotyped responses to stimuli. The spinal cord contains input region where ascending axonal tract passing through it and it has also output region where descending axonal tract send back the motor output to the muscle. Thus, ascending sensory neurons reach the spinal cord via dorsal pathway and the descending motor neurons leave the spinal cord via ventral pathway.

Question 6.

Lesion to the spinal cord often affect sensory and motor functions in all body parts below the level of the lesion. Lesion to spinal cord cannot be compensated and it is an incurable impairment even with the best possible treatment. This limitation for the recovery after spinal cord lesion is due to the fact that there is

no regeneration of neurons in central nervous system (brain and spinal cord) in compare to peripheral nervous system. Some protein such as Nogo protein, myelin associated glycoprotein and oligodendrocyte myelin glycoprotein inhibit axonal regeneration.