1. What is the net joint force, in the static case, at the ankle joint (AJC) given the situation in the sketch?

\[ F_{vert} = 1500 \text{ N} \]
\[ F_{hor} = 500 \text{ N} \]
\[ m_{foot} = 1.5 \text{ kg} \]

Need to solve the equations of motion as given in the ‘knee lecture’.

As this is a static case, all accelerations are zero. Therefore:

\[ F_{ankhor} = F_{hor} \Rightarrow (\text{inserting numbers}) F_{ankhor} = 500 \text{ N} \]
\[ F_{ankvert} = F_{vert} - F_{w(foot)} = F_{vert} - m_{foot} \times g \Rightarrow (\text{inserting numbers}) F_{ankvert} = 1500 \text{ N} - 1.5 \text{ kg} \times 10 \text{ m/s}^2 = 1350 \text{ N} \]

Total or resultant force \( F_{anktotal} \) to be calculated with Pythagoras
\[ F_{anktotal} = \sqrt{F_{ankhor}^2 + F_{ankvert}^2} \]
\[ \Rightarrow (\text{inserting numbers}) F_{anktotal} = 1439.6 \text{ N} \]

2. Add the names to all ankle ligaments to the slides in the lecture notes.
3 Which of the muscles crossing the ankle joints is the main everter? What is this muscle’s stretch reflex latency $f$? Discuss implications for injury prevention? I.e., can this muscle prevent injuries by reflex activation?

This is the peroneus muscle group. It consists of the peroneus longus and peroneus brevis.

In a tilt-board study Eils & Rosenbaum (The Main Function of Ankle Braces is to Control the Joint Position Before Landing. Foot & Ankle International/Vol. 24, No. 3/March 2003, p. 263 – 268) have shown that peroneus activity only starts ~51 ms after start of the tilt movement. It will take another few ms before the muscle develops substantial force so reflexes are most likely too late to stabilize the joint following unexpected tilt. The only way might be to increase preactivation and thereby stiffening the joint prior to contact.

4 What is the main result of the Ubell-study? Which injury mechanism was tested? Do you think this is realistic? How does this relate to the mechanism mentioned on slide 33?

Semi-rigid ankle braces significantly improve success rate in a task randomly provoking foot inversion. As far as visible from the figures a pure inversion movement was tested. The authors argue that the test resembles jump landings of more or less vertical jump types. The study is strong as they manage to simulate a specific injury situation. However, it only tests this particular situation. The foot is basically starting in a neutral position. On slide 33 the foot is landing in a disadvantageous geometry which may be more likely in non-contact ankle injuries. So these two mechanisms are completely different. The important observation is that results from both studies do not cover the whole picture.

5 How would you train for ankle injury prevention? Outline a training program with general and some specific exercises; and provide arguments for their usefulness.

It is unlikely that reflex latencies can be changed – well, some studies claim this but it is not clear if the amount of change is practically relevant. Together with what was said above (Question 3) it is unlikely that this can be trained. Joint stiffness, preactivation, foot positioning or landing and cutting technique can be trained. Therefore, footwork, landing technique training, or balance board training seem to be successful training programs. See [http://www.ostrc.no/no/Skadefri/](http://www.ostrc.no/no/Skadefri/) for ideas.