**I. Pen-and-paper**

1. .
2. Answer 2
3. Answer 3
4. Answer 4

**II. Programming and critical analysis**

1)

A screenshot of a computer code

Description automatically generated

A black text on a white background

Description automatically generated A close-up of a white background

Description automatically generated

A computer screen shot of a code

Description automatically generated

A graph of a patient

Description automatically generated with medium confidence

**2)**

A screenshot of a computer program

Description automatically generated

A graph with blue and orange lines

Description automatically generated

**3)**

Generalization capacity across different settings is poor, as the average testing accuracy is lower than the training accuracy. Overfitting becomes more pronounced with increasing maximum depth, as evidenced by the widening gap between the training and testing accuracy lines. This suggests that the model is learning complex patterns in the training data that do not generalize well to new data. Despite having lower training accuracy, shallower models produce the best testing results.

4)

i)

A computer screen shot of a code

Description automatically generated

A diagram of a tree

Description automatically generated

ii)

By analyzing the Decision Tree we can see that the biomechanical features that best predict the condition of hernia are:

1. Degree of spondylolisthesis

2. Sacral slope

3. Pelvic radius

Starting from the root node we see that a degree of spondylolisthesis greater than 16 will classify the patient as normal.

If lower, we look at the Sacral slope that if lesser than 28 also classifies the patient as having the hernia condition.

Only then will we look at the Pelvic radius, that if lesser than 117 and in combination with a sacral slope lesser than 440 leads to a hernia condition.

Therefore, the conditional associations are the following:

- Degree of spondylolisthesis <= 16.079 -> sacral slope <= 28.136

- Degree of spondylolisthesis <= 16.079 -> sacral slope > 28.136 -> pelvic radius <= 117.36 -< sacral slope <= 20.149

**END**