Overfitting

Background Story:
Imagine you are an instructor for a course.
Your students learn from the materials which are from the lecture notes and assignments.
Now, you have to design a final exam for the students to test their understanding of the materials.
Question: What would happen if your final exam only involves questions from the lecture notes and assignments?
Answer: Every student can get 100% by just memorizing everything from the lecture notes and assignments.
Question: What would happen if your final exam does not involve questions only from the lecture notes and assignments?
Answer: Every student won't be able to score 100%.
Moral of the Story: To test whether the students really understood the material and generalize what they learn to solve problems, the final exam should contain problems different from the problems presented in the lecture notes and assignments, but nevertheless require tools and skills taught from the lectures to solve.

Relation to Overfitting:

A model overfits when it simply memorizes the data, e.g. a curve that fit through every training data (or, the lecture notes and assignments). If the overfitted model is tested on the training data (or, testing the students with a final exam containing only lectures/assignments questions), the model will give 0 training error (or, every student gets 100%). So, to really test the model generalization ability, the model should be tested on unseen test cases (or, a final exam containing questions different from those presented in lectures/assignments).
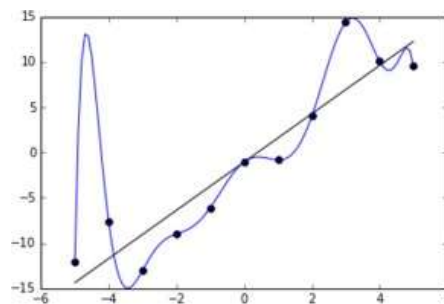

Figure 1

References:

For more details on Overfitting:
https://en.wikipedia.org/wiki/Overfitting
https://machinelearningmastery.com/overfitting-and-underfitting-with-machine-learning-algorithms/