

Test 1 for Uncertainty in AI class, Fall 2025

1. Why cannot we just use machine learning to estimate the degree of confidence in its predictions – and to estimate how accurate are these predictions?
- 2a. If we know that the subjective probability of an event is between 0.6 and 0.8, and we want to find this probability with higher accuracy, what shall we do?
- 2b. How many questions do we need to ask a user to get his/her subjective probability with accuracy 5%?
3. If 9 experts out of 12 think that the sock market will go down by the end of the year, what is the resulting degree of confidence?
4. Assuming that utility is proportional to the square root of money amount, would a person prefer \$1 without any condition or \$900 with probability 0.01?
5. Why, for the smooth utility, moments are the most appropriate way of describing probability information when we need to make a decision?
- 6a. If a value is 0 with probability 0.2, 10 with probability 0.3, and 20 with probability 0.5, what is the value $F(4)$ of the corresponding cumulative distribution function? what is the value of $F(30)$?
- 6b. If a value is 0 with probability between 0.1 and 0.3, 10 with probability between 0.2 and 0.4, and 20 with the remaining probability, what is the interval value $F(4)$ of the corresponding p-box? what is the value of $F(30)$?
7. If a value is 0 with probability 0.125, 10 with probability 0.125, 20 with probability 0.5, and 30 with probability 0.25, then how many binary questions do we have to ask, on average, to find the exact value?
8. Suppose that we have three different models of how fly epidemic spreads, and we use these models to estimate the probability that flu epidemic will reach El Paso in October. According to Models 1 and 3, this probability is 0.6, while Model 2 estimates the probability as 0.59. If the epidemic does reach El Paso in October, which model should we select if we use the Maximum Likelihood method? Which model should we select if in October, the epidemic will not yet reach El Paso?
9. Suppose that we are use the Least Squares method for find the coefficients a and b of the linear dependence $y = a \cdot x + b$ between the quantities x and y .

Based on the measurements $x_1 = 0$, $y_1 = 0$, $x_2 = 1$, $y_2 = 0$, $x_3 = 2$, $y_3 = 2$, what are the most probable values of a and b ?

10. If we know that the accuracy of x_1 is described by standard deviation $\sigma_1 = 0.01$, and the accuracy of x_2 is described by standard deviation $\sigma_2 = 0.03$, what is the accuracy of $y = 4x_1 + x_2$?