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| **Exercise 2: Theory of probabilities**   1. Given two random variables A and B. Each of them has three possible values.  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | | **B** | | | | **B1** | **B2** | **B3** | | **A** | **A1** | 0.05 | 0.02 | 0.23 | | **A2** | 0.18 | 0.04 | 0.35 | | **A3** | 0.02 | 0.02 | 0.1 |  1. Compute    * All the possible marginal probabilities of the variable B.  * P(B=B1) =P(B=B1, A) = Σi P(B=B1, A=Ai) = 0.05+0.18+0.02 = 0.25 * P(B=B2) =P(B=B2, A) = Σi P(B=B2, A=Ai) = 0.02+0.04+0.02 = 0.08 * P(B=B3) =P(B=B3, A) = Σi P(B=B3, A=Ai) = 0.23+0.35+0.1 = 0.68   + P(A=A1, B=B1) = 0.05   + P(A=A2|B=B1) = P(A=A2 , B=B1)/P(B=B1) = 0.18/0.25 = 0.72 |
| **2.** Given the following table where **X** and **Y** are two random variables and the values inside the table are probabilities.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | **X** | | | |  |  | **x1** | **x2** | **x3** | | **Y** | **y1** | 0.1 | 0.1 | 0.1 | | **y2** | 0.3 | 0.2 | 0.2 |      1. What is the name of the table above?    * Joint probability distribution table 2. Are **X** and **Y** dependent or independent?     **Answer:**  Take one case, X = x1 and Y = y2  P(X=x1, Y=y2) = 0.3  P(X=x1) = 0.1+0.3 = 0.4  P(Y=y2) = 0.3+0.2+0.2 = 0.7  P(X=x1) . P(Y=y2) = 0.28.  Since P(X=x1, Y=y2) != P(X=x1) . P(Y=y2), therefore X and Y are not independent. |