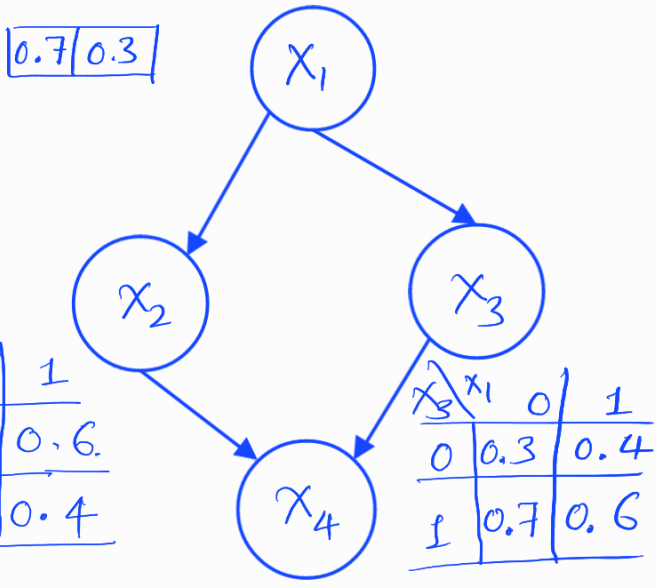
Is Bayesian Network a generative model?

- Yes
- Because it learns the underlying distribution.

Joint Probability

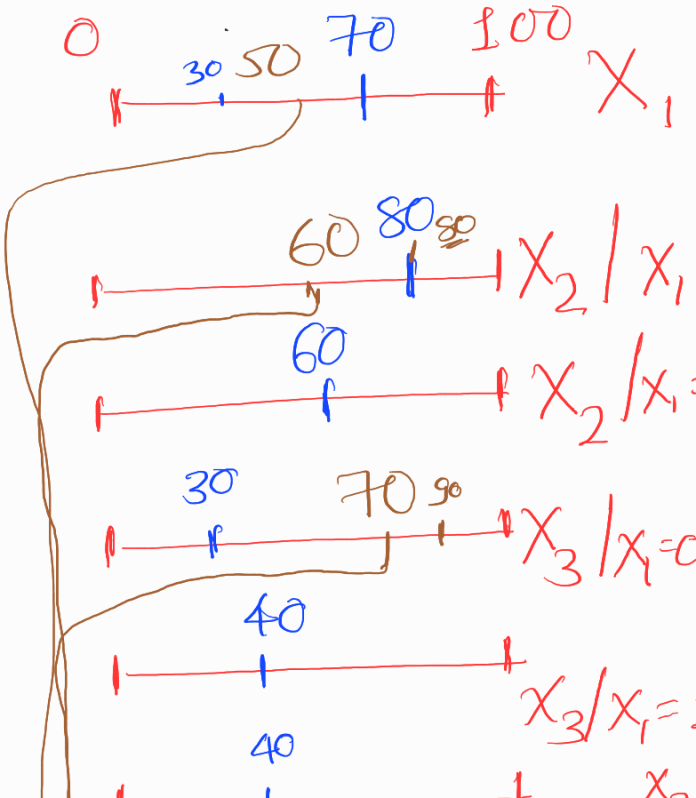
$P(X_1, X_2, X_3, X_4)$

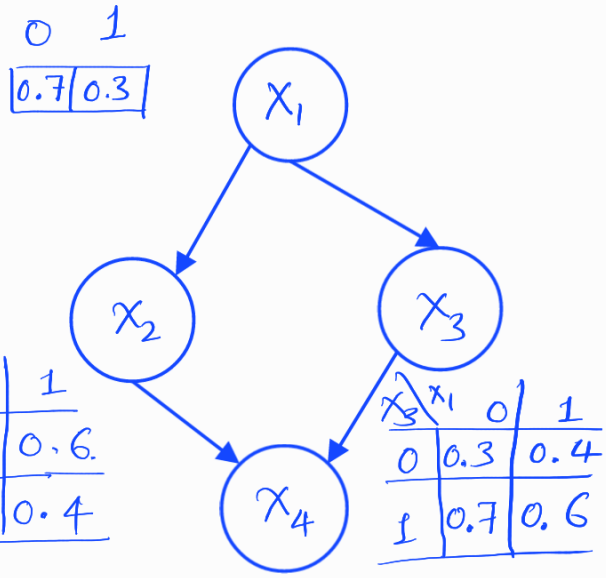



| $X_1$ | $X_2X_3$ = 00 | 01 | 10 | 11 |
|---|---|---|---|---|
| 0 | 0.4 | 0.5 | 0.7 | 0.3 |
| 1 | 0.6 | 0.5 | 0.3 | 0.7 |

- In generative model. You can generate new samples / Example data points.
- How to generate new sample/datapoint ?

## Random Sampling

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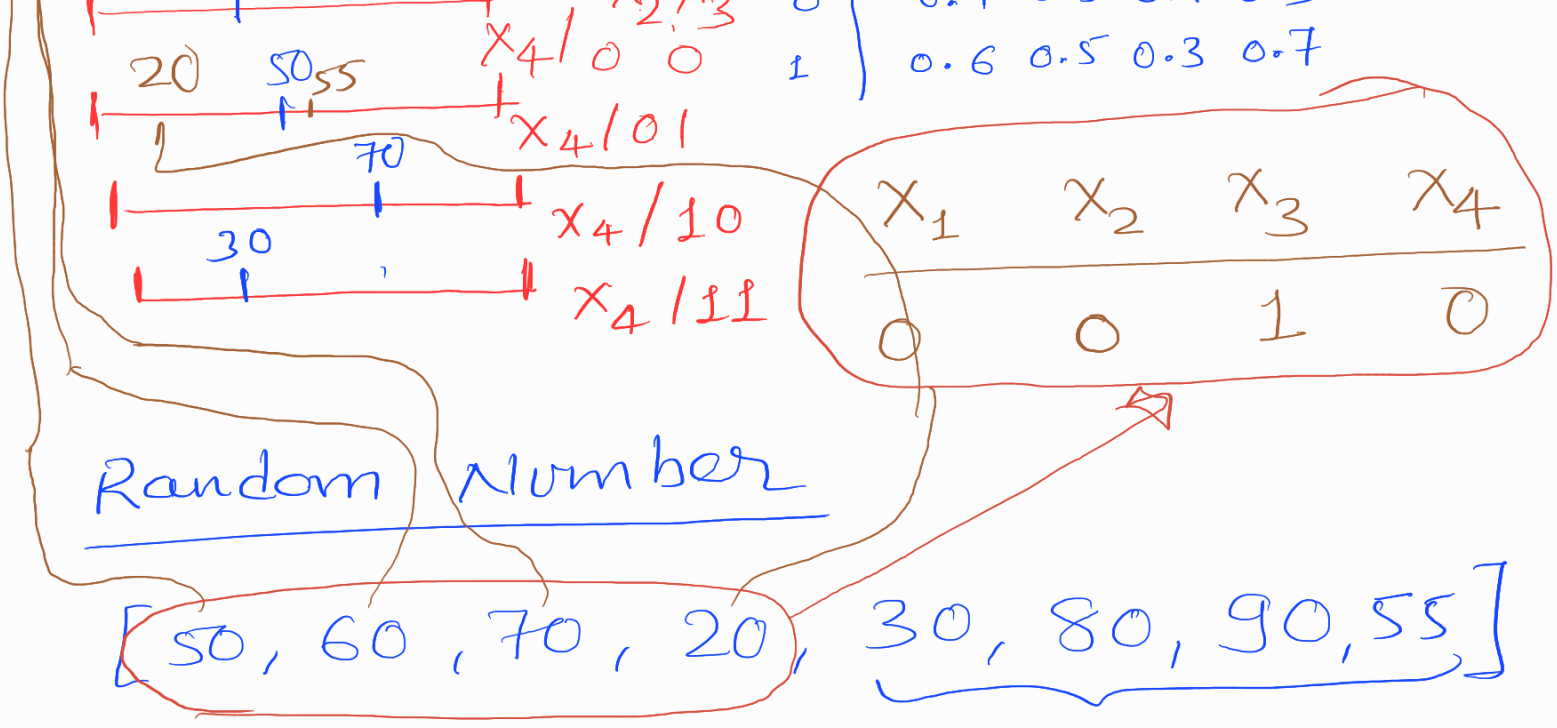


| $X_1$ | $X_2$ | $X_3$ | $X_4$ |
|---|---|---|---|
| 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 |

$P(X_4 = 1 / X_3 = 0) = ?$

$P(X_4 = 1 / X_3 = 1) = 1/2$

## Approximate Inference Using Random Sampling

1. We generate N random numbers
2. We scan Bayesian Network in top-to-bottom order and choose random variables sequentially
3. Assign value to the random variable as per the random number selected and the probability of the R.V.

④ Keep repeating this until you create sufficiently large number of samples.

⑤ Use the generated data to answer inference query

## Rejection Sampling

- We generate only these samples which are useful to answer inference query

e.g $P(X_4 = 1 / X_3 = 0)$

" reject samples if value of $X_3 = 1$ "

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