2. Bayesian Networks.

ia). $A \perp\!\!\!\perp C \mid B, D$.

When conditioned on B and D all the paths are blocked between A and C, hence this is **True**.

Mathematically.

$$\frac{P(A,B,C,D)}{P(B,D)} = \frac{P(A|B,D)\,P(B|A,C)\,P(C|B,D)\,P(D|A,C)}{P(B|A,C)\,P(D|A,C)}$$

$$= P(A|B,D)\,P(C|B,D)$$

Therefore $A \perp\!\!\!\perp C \mid B,D$ is True

×——————×

. $B \perp\!\!\!\perp D \mid A, C$

When conditioned on A and C all the paths are blocked between B and D, hence this is True.

Mathematically.

$$\frac{P(A,B,C,D)}{P(A,C)} = \frac{P(A|B,D)\,P(B|A,C)\,P(C|B,D)\,P(D|A,C)}{P(A|B,D)\,P(C|B,D)}$$

$$= P(B|A,C)\,P(D|A,C).$$

$\therefore$ $B \perp\!\!\!\perp D \mid A, C$ is True

×——————×.