Q2 Bayesian Networks.

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

This is $\boxed{\text{False}}$ because even when B, D are observed there is still an active path b/w A and C as the path becomes unblock. In this case B and D are head to head.

Mathematically.

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

$$\neq P(A)\,P(C)$$

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

• $B \perp\!\!\!\perp D \mid A, C$

When conditioned on A & C all the path b/w B and D remain blocked and are therefore inactive.

Hence, this statement is $\boxed{\text{True}}$

Mathematically.

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

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

$\therefore \boxed{B \perp\!\!\!\perp D \mid A,C \text{ is True}}$