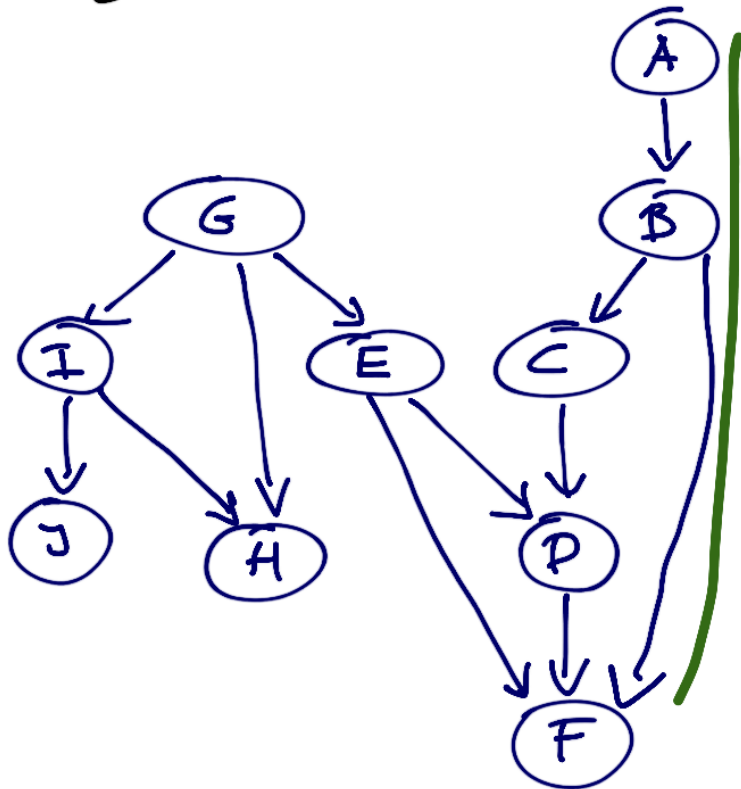


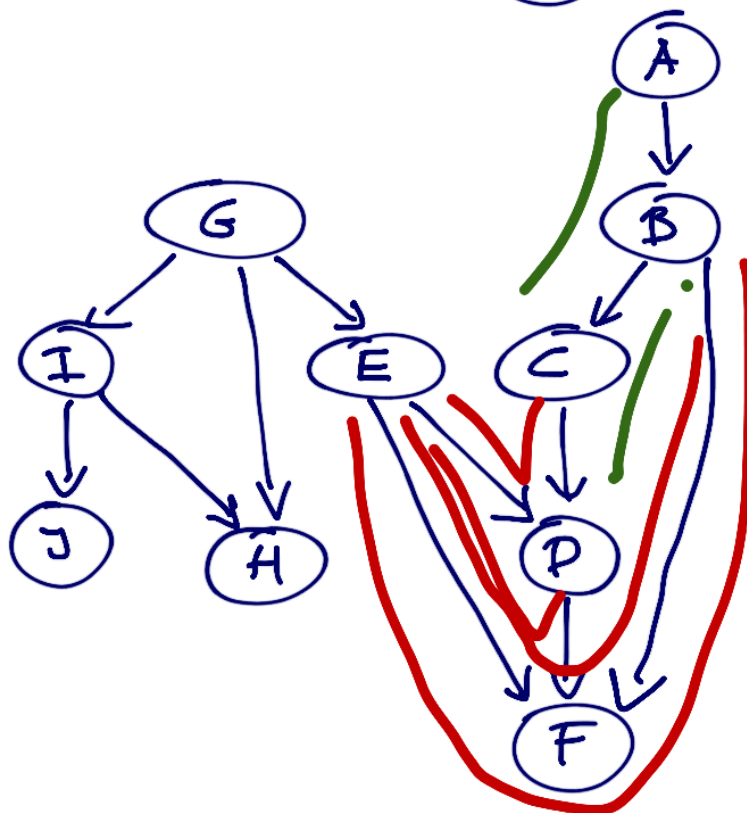
Problem Set 2

Bayesian Networks: d-separation



$A \perp\!\!\!\perp F$: No

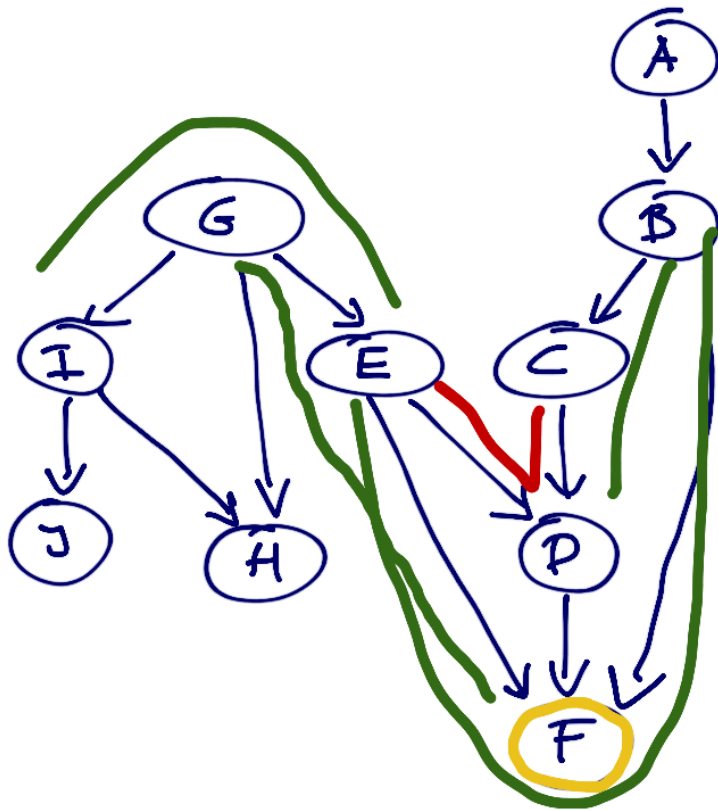
Active trail: ABF



$A \perp\!\!\!\perp G$: Yes

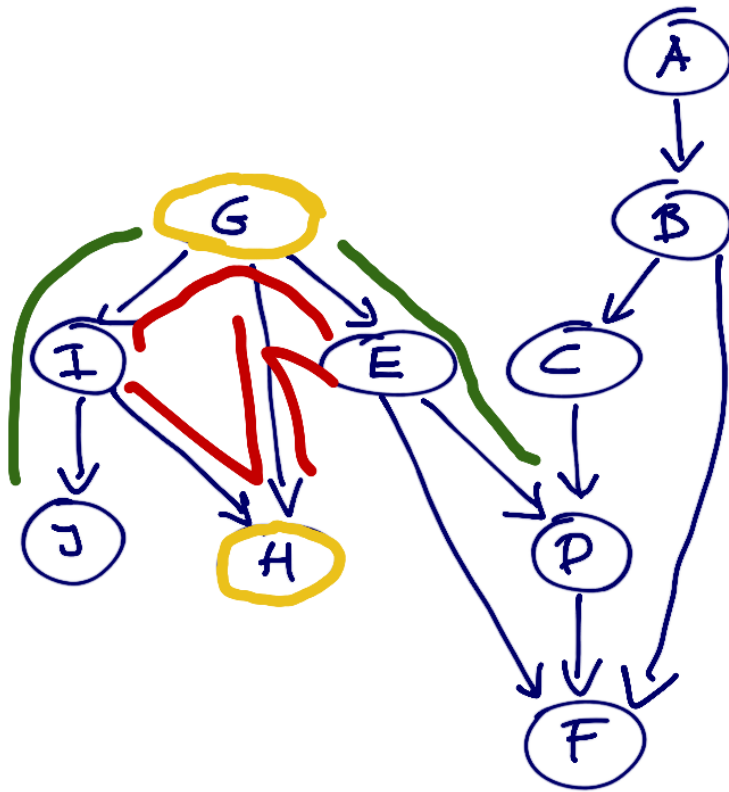
Active trail

no-Active trail

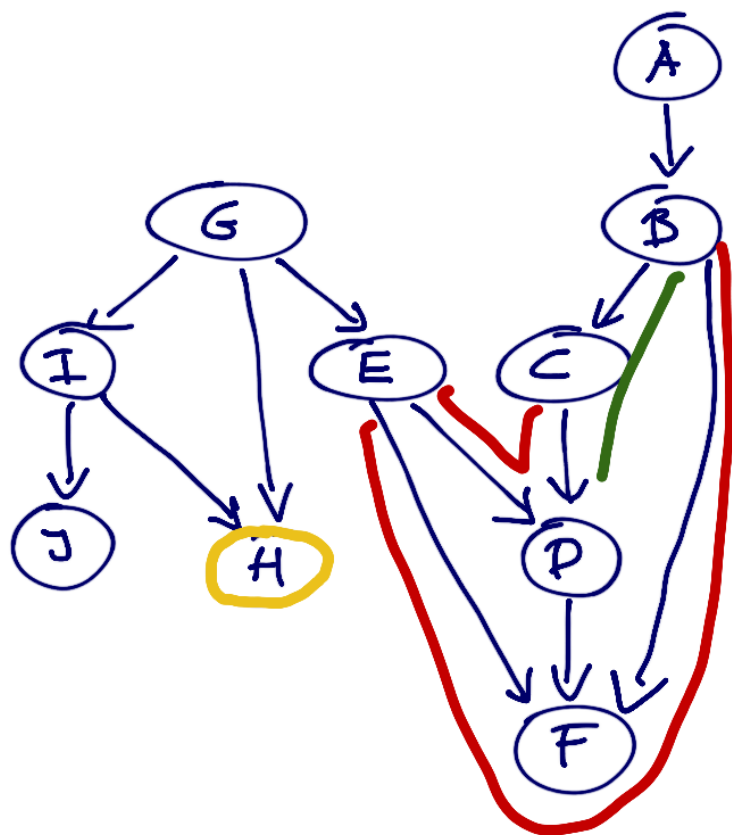


3. $B \perp I \mid F$: No

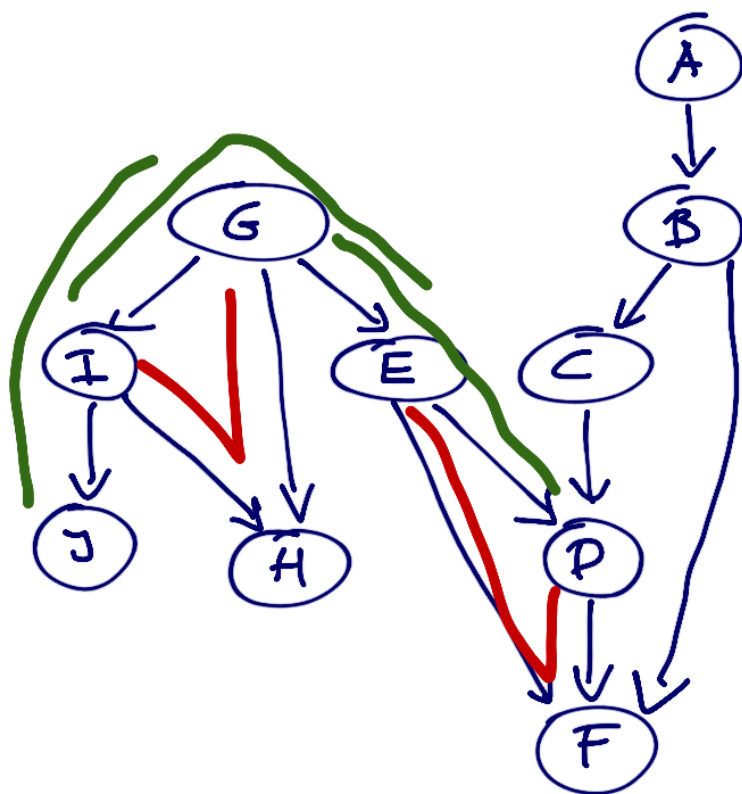
Active trail: BFEGI



4. $D \perp J \mid G, H$: Yes

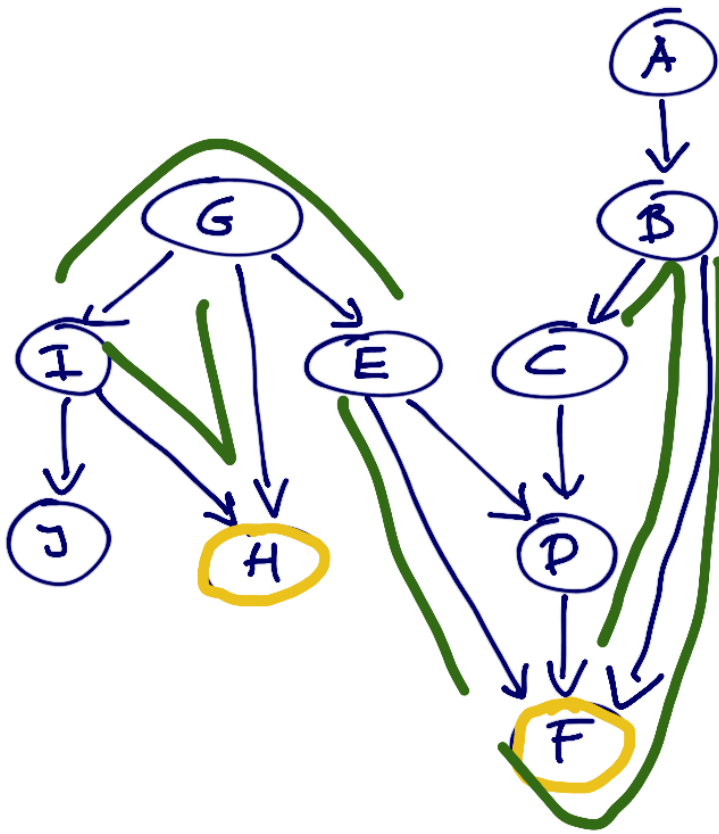


5. $I \perp B \mid H$: Yes



6. $J \perp D$: No

Active trail: JIGED



7. $I \perp C \mid H, F$: No
Active trail: $I G E F B C$

Bayesian Networks: Variable elimination

$$P(A \dots J) = P(A)P(B|A)P(C|B)P(D|C,E)P(E|G)P(F|B,D,E)P(G) \cdot P(H|G,I)P(I,G)P(J|I)$$

eliminating A: $P(B \dots J) = P(C|B)P(D|C,E)P(E|G)P(F|B,D,E)P(G)P(H|G,I)P(I,G)P(J|I)g_1(B)$

$$g_1(B) = \sum_a P(a)P(B|a)$$

eliminating B: $P(C \dots J) = P(D|C,E)P(E|G)P(G)P(H|G,I)P(I,G)P(J|I)g_2(C,D,E,F)$

$$g_2(C,D,E,F) = \sum_b P(C|b)P(F|b,D,E)$$

eliminating C: $P(D \dots J) = P(E|G)P(G)P(H|G,I)P(I,G)P(J|I)g_3(D,E,F)$

$$g_3(D,E,F) = \sum_c P(D|c,E)g_2(c,D,E,F)$$

eliminating D: $P(E \dots J) = P(E|G)P(G)P(H|G,I)P(I,G)P(J|I)g_4(E,F)$

$$g_4(E,F) = \sum_d g_3(d,E,F)$$

eliminating E: $P(F \dots J) = P(G)P(H|G,I)P(I,G)P(J|I)g_5(F,F)$

$$g_5(F,F) = \sum_e P(e|F)g_4(e,F)$$

eliminating F: $P(G \dots J) = P(G)P(H|G,I)P(I,G)P(J|I)g_6(G)$

$$g_6(G) = \sum_f g_5(f,G)$$

eliminating G: $P(H \dots J) = P(J|I)g_7(H,I)$

$$g_7(H,I) = \sum_g g_6(g)P(g)P(H|g,I)P(I|g)$$

eliminating H: $P(I,J) = P(J|I)g_8(I) \quad g_8(I) = \sum_h g_7(h,I)$

eliminating I: $P(J) = g_9(J) = \sum_i P(J|i)g_8(i)$