Implementing Link Prediction Models for Network Analysis

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Module Overview

Introduce link prediction for networks

Understand and implement link prediction using common neighbors

Understand and implement link prediction using Jaccard Coefficient

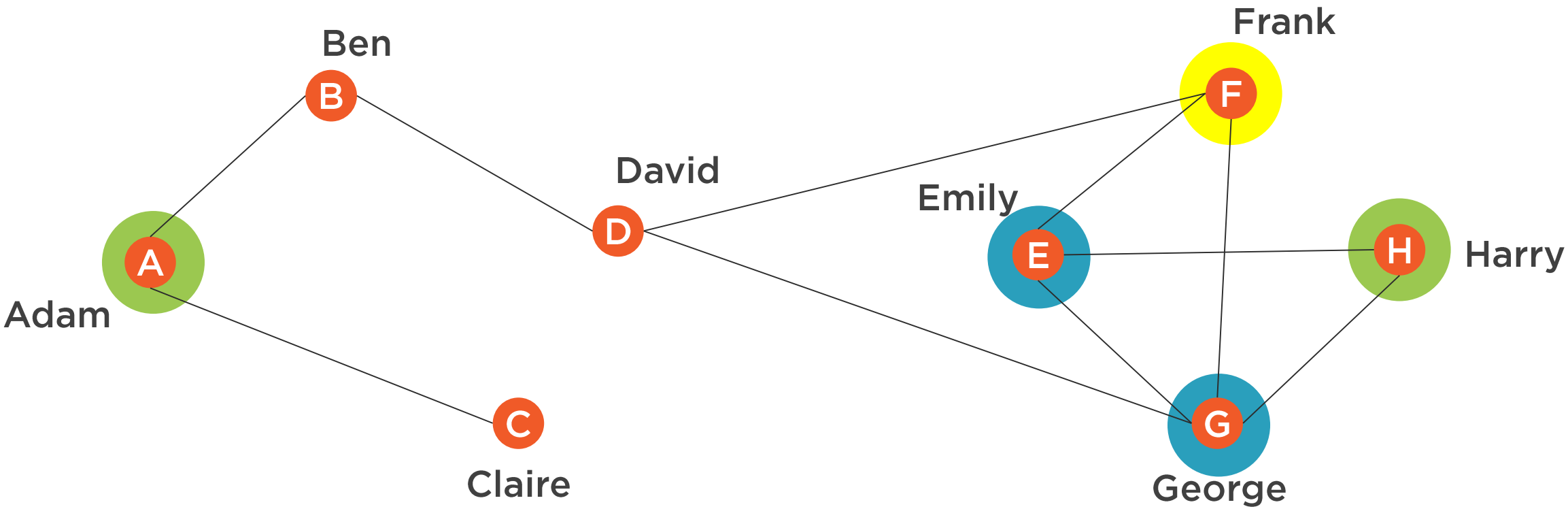
Understand and implement link prediction using preferential attachment

Understanding Link Prediction

Link Prediction

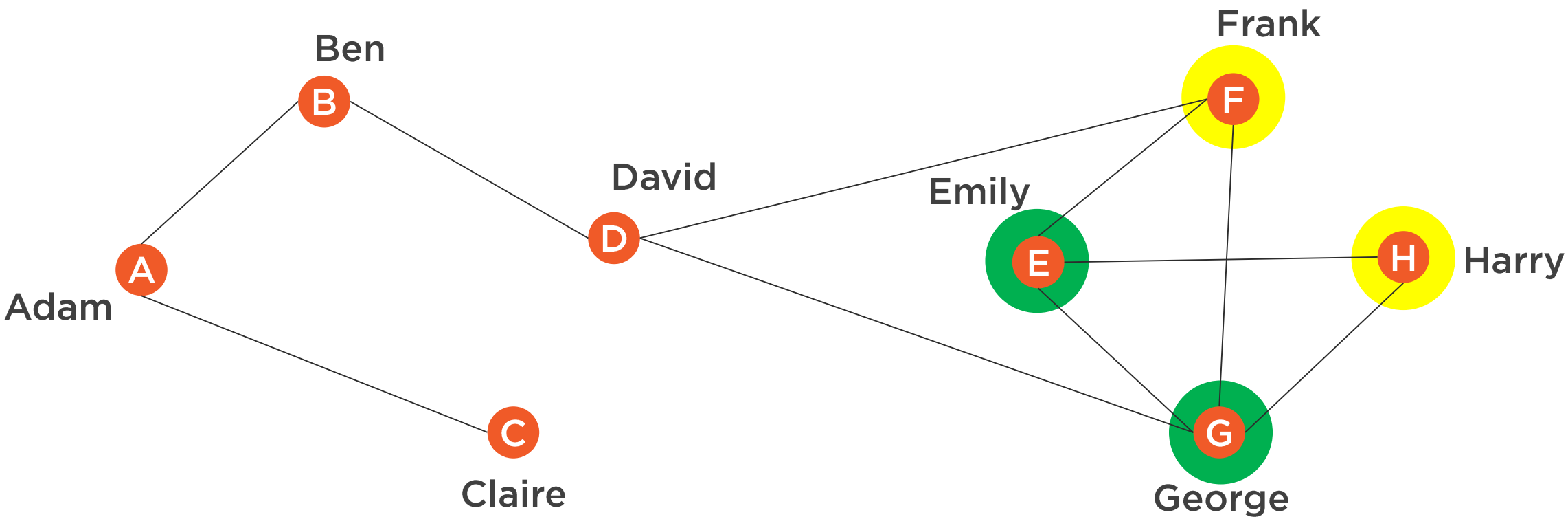
An approach to predict some potentially unknown, missing, or future links between nodes in a network.

Link Prediction



Link Prediction with Common Neighbors

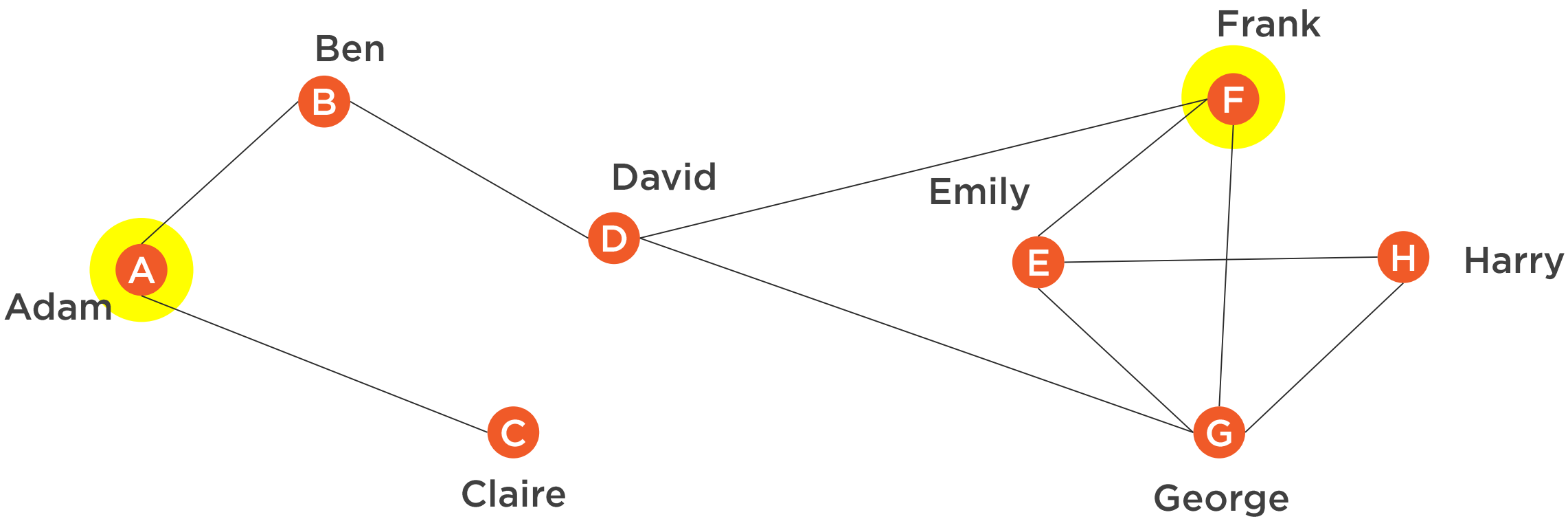
Link Prediction – Common Neighbors



$$CommonNeighbors(X, Y) = |N(X) \cap N(Y)|$$

$$CommonNeighbors(F, H) = |\{D, E, G\} \cap \{E, G\}| = |E, G| = 2$$

Link Prediction – Common Neighbors



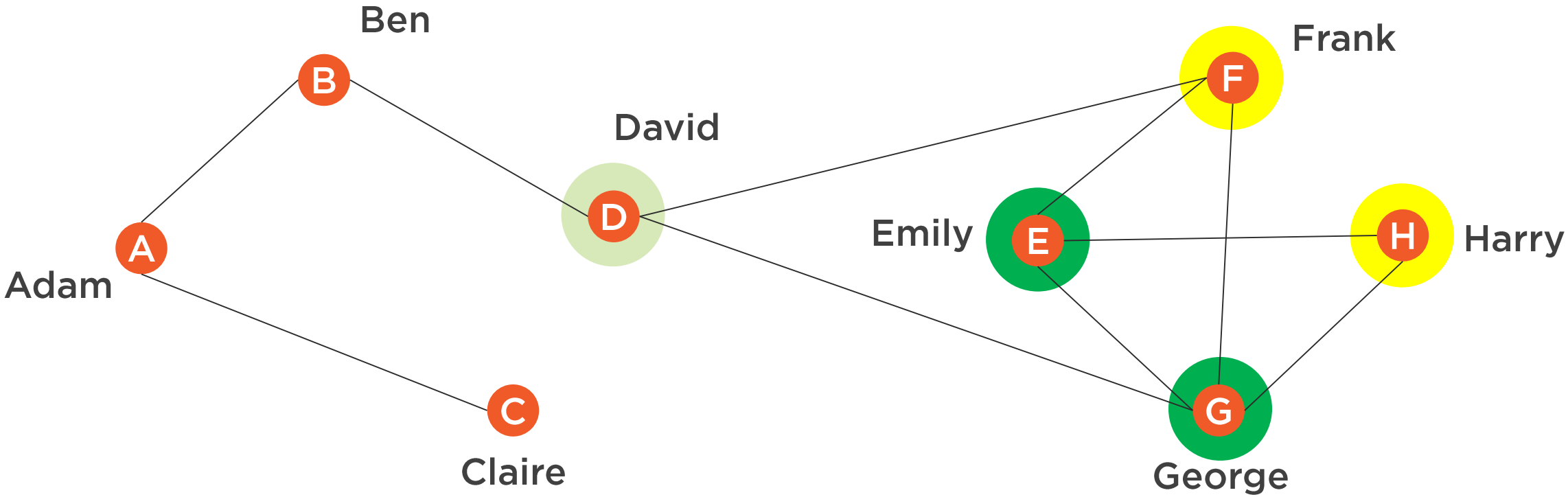
$$CommonNeighbors(X, Y) = |N(X) \cap N(Y)|$$

$$CommonNeighbors(F, H) = |\{D, E, G\} \cap \{E, G\}| = |E, G| = 2$$

$$CommonNeighbors(A, F) = |\{B, C\} \cap \{D, E, G\}| = |none| = 0$$

Link Prediction with Jaccard Coefficient

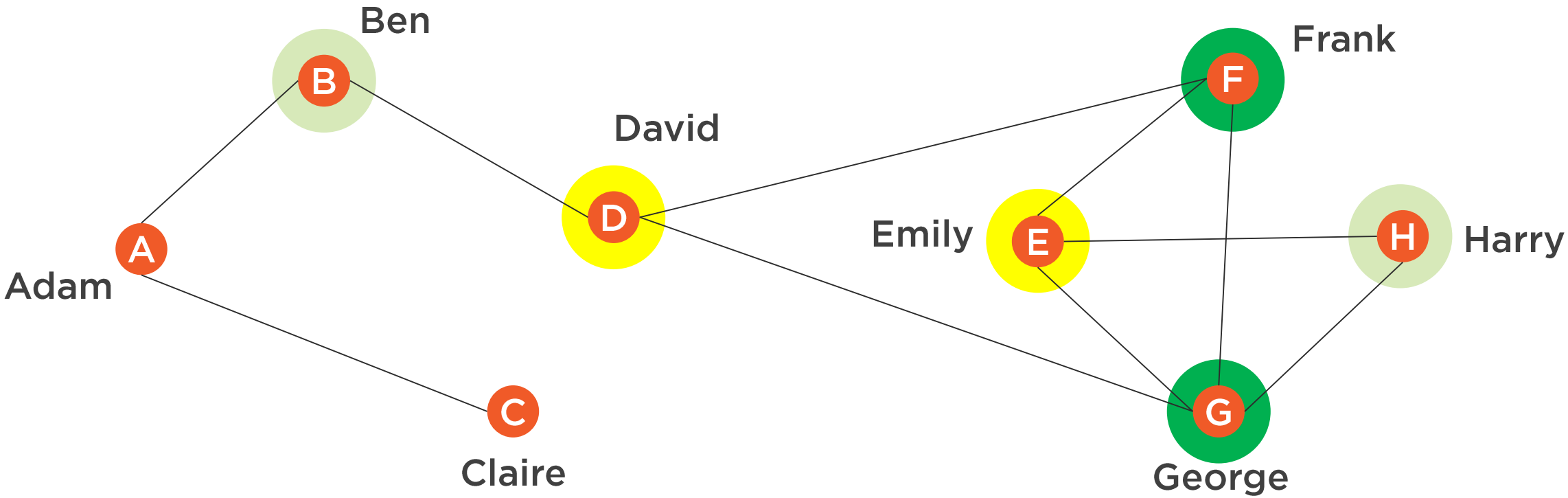
Link Prediction – Jaccard Coefficient



$$JaccardCoefficient(X,Y) = \frac{|N(X) \cap N(Y)|}{|N(X) \cup N(Y)|}$$

$$JaccardCoefficient(F,H) = \frac{|E,G|}{|D,E,G|} = \frac{2}{3} = 0.66$$

Link Prediction – Jaccard Coefficient

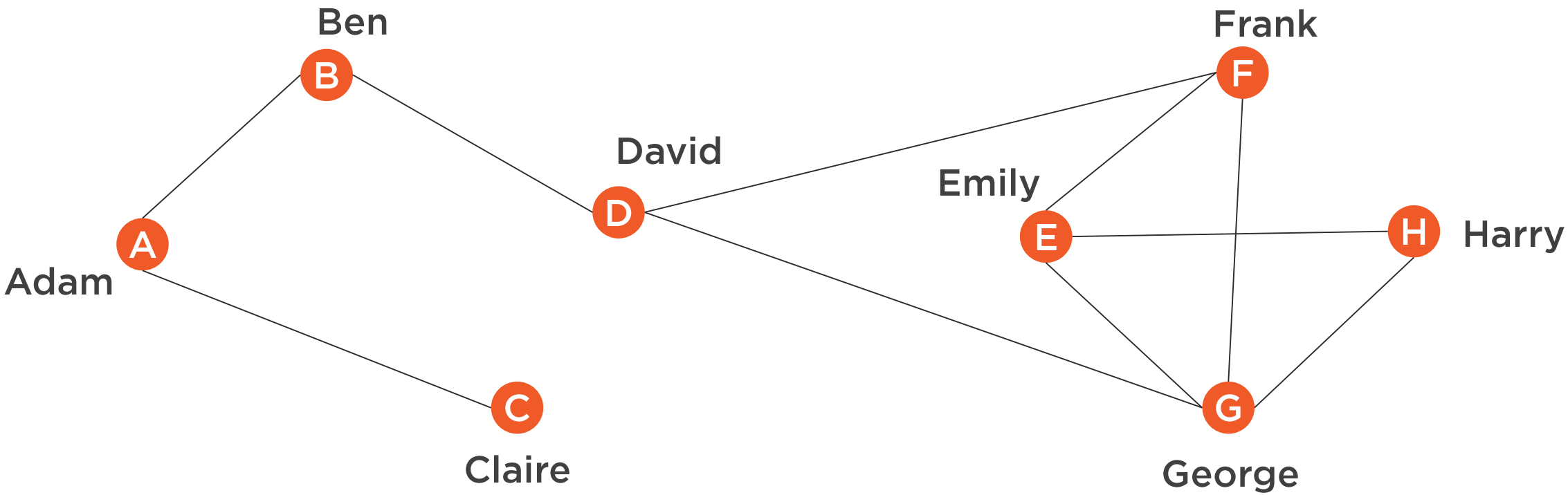


$$JaccardCoefficient(X,Y) = \frac{|N(X) \cap N(Y)|}{|N(X) \cup N(Y)|}$$

$$JaccardCoefficient(F,H) = \frac{|E,G|}{|D,E,G|} = \frac{2}{3} = 0.66 \qquad JaccardCoefficient(E,D) = \frac{|F,G|}{|B,F,G,H|} = \frac{2}{4} = 0.5$$

Link Prediction with Preferential Attachment

Link Prediction – Preferential Attachment



$$PreferentialAttachment(X, Y) = |N(X)||N(Y)|$$

$$PreferentialAttachment(F, H) = |3||2| = 6$$

$$PreferentialAttachment(E, D) = |3||3| = 9$$

Summary

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Understood and implemented link prediction using Jaccard Coefficient

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