Fig. 1: A simple Bayes net with Boolean variables $B = BrokeElectionLaw$, $I = Indicted$, $M = PoliticallyMotivatedProsecutor$, $G = FoundGuilty$, $J = Jailed$.

6. (16 pts.) Probabilistic inference

Consider the Bayes net shown in Fig. 1.

(a) (3) Which, if any, of the following are asserted by the network *structure* (ignoring the CPTs for now)?
(i) $\mathbf{P}(B, I, M) = \mathbf{P}(B)\mathbf{P}(I)\mathbf{P}(M)$
(ii) $\mathbf{P}(J|G) = \mathbf{P}(J|G, I)$
(iii) $\mathbf{P}(M|G, B, I) = \mathbf{P}(M|G, B, I, J)$

(b) (2) Calculate the value of $P(b, i, \neg m, g, j)$.

(c) (4) Calculate the probability that someone goes to jail given that they broke the law, have been indicted, and face a politically motivated prosecutor.

(d) (2) A *context-specific* independence has the following form: X is conditionally independent of Y given Z in context $\mathbf{C} = \mathbf{c}$ if $\mathbf{P}(X|Y, Z, \mathbf{C} = \mathbf{c}) = \mathbf{P}(X|Z, \mathbf{C} = \mathbf{c})$. In addition to the usual conditional independences given by the graph structure, what context-specific independences exist in the Bayes net in Fig. 1?

(e) (5) Suppose we want to add the variable $P = Presidential Pardon$ to the network; draw the new network and briefly explain any links you add.