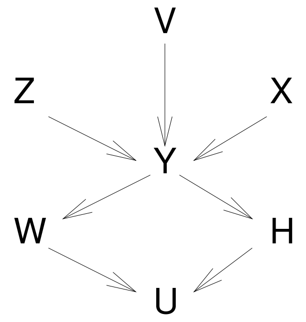
??. Baysian Networks

1 Problems

Problem 3.(10 points) Consider the following Bayesian network.



Let $I(X,\ Z,\ Y)$ mean that variables X and Y are independent given a value for Z, i.e., $P_r(X = x_i \wedge Y = y_k | Z = z_j) = P_r(X = x_i | Z = z_j) P_r(Y = y_k | Z = z_j)$. The following table gives a series of independence statements of this form. Label each statement as either T or F depending on whether the independence statement can be inferred from the connectivity of the above Bayesian network. (Warning: the solution to problem set 3 contains a condition on nodes in a Bayesian network that guarantees independence. In networks that are not trees this condition is sufficient but not necessary.)

	T or F
$I(X,\ V,\ Z)$	
$I(X,\ Y,\ Z)$	
$I(W,\ Y,\ H)$	
$I(W,\ U,\ H)$	

Problem 3. Consider the Bayesian Network shown below. Each node represents a Boolean variable (which can take on the values T and F). Assume that $P_r(I_1) = .5$ and for each like in the network $P \rightarrow Q$ we have that $P_r(Q|P) = .75$ and $P_r(Q|\neg P) = .25$. Suppose we observe the "data" $D_2 \wedge \neg D_3 \wedge D_4 \wedge D_5$ Calculate, to three significant figures, each of the six probabilities of the form $P_r(I_j | D_2 \wedge \neg D_3 \wedge D_4 \wedge D_5)$. Hint: First compute

$P_r(D_2 \wedge \neg D_3 \wedge D_4 \wedge D_5)$ (this is fairly easy). Then use local propagation to compute the relevant four quantities for each proposition symbol I_j. Use a calculator. Explain your calculation technique and give some of your intermediate results.