

In the Name of God, The Compassionate, The Merciful

Name : .....

Student ID# : .....

**Statistical Pattern Recognition**  
**Department of Computer Engineering**  
**Mini Exam #2 (Graphical Models) – Spring 2011**

Q1. [60 Pts.] Assume that  $X_1, \dots, X_n, \dots$  has the Markov property with  $X_i$  takes value in  $\{0, 1\}$ . We have:

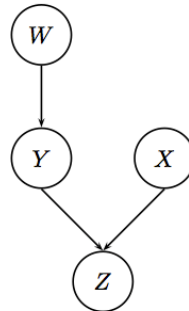
$P(X_i = 1   X_{i-1} = 1)$	0.5
$P(X_i = 0   X_{i-1} = 0)$	0.7

We know that  $P(X_i = 0) = 0.5$ . Further assume that we have another sequence of random variables  $Z_1, \dots, Z_n, \dots$  such that each  $Z_i$  takes its value in  $\{0, 1\}$  and is conditionally independent of all other variables given  $X_i$ . We have :

$P(Z_i = 1   X_i = 0)$	1
$P(Z_i = 0   X_i = 1)$	0.4

Find  $P(Z_3 = 0 | Z_1 = 0)$ .

Q2. [40 Pts.] Consider the following Bayesian network with each variable taking value in  $\{0, 1\}$  :



Find the following probabilities, based on the conditional probabilities of each node given all its parents:

- a)  $P(Z=1 | W=1, X=1)$
- b)  $P(W=1 | X=1, Y=1, Z=1)$