

## IAIP Exercises Week 2

### **Relations**

1. (\*) R. Dechter p. 21: exercise 1.5.1

### **Graphs**

1. Consider a directed graph  $G = (V, E)$ , where  $V = \{A, B, C, D, E, F\}$  and  $E = \{(B, B), (F, C), (E, D), (D, A), (A, B), (B, D), (B, E), (D, E)\}$ .
  - a. What is the adjacency matrix of  $G$ ?
  - b. Draw  $G$
  - c. What is the in and outdegree of B?
  - d. Is  $G$  connected?
  - e. How many simple cycles does  $G$  contain?
2. (\*) Show that in any graph, the number of vertices with odd degree is even. (Hint: every edge joins two vertices including, for the purpose of degree, loops)
3. Show that any connected, undirected graph  $G = (V, E)$  satisfies  $|E| \geq |V| - 1$ .

### **Complexity**

1. (\*) Indicate, for each pair of  $f(n)$  and  $g(n)$  in the table below, whether  $f(n)$  is  $O$ ,  $o$ ,  $\Omega$ ,  $\omega$ , or  $\theta$  of  $g(n)$ . Assume that  $k \geq 1$  and  $c > 1$  are constants. Your answer should be in the form of the table with “yes” or “no” written in each box

	A	B	$O$	$o$	$\Omega$	$\omega$	$\theta$
a.	$n^2$	$n$					
b.	$\lg n$	$\ln n$					
c.	$\lg n$	$\sqrt{n}$					
d.	$n^k$	$c^n$					