

### Discrete Mathematics: Solutions Additional Exercises to Lecture 3

1. (a)

$$\exists j \in \{1, \dots, n\} \forall i \in \{1, \dots, m-1\} [a_{ij} < a_{i+1j}]$$

or

$$\exists j \forall i [j \in \{1, \dots, n\} \wedge (i \in \{1, \dots, m-1\} \rightarrow a_{ij} < a_{i+1j})]$$

(b)

$$\exists j \in \{1, \dots, n\} [a_{1j} = 0 \wedge \forall i \in \{1, \dots, n\} (a_{1i} = 0 \rightarrow i = j)]$$

or

$$\exists j \in \{1, \dots, n\} [a_{1j} = 0 \wedge \forall i \in \{1, \dots, n\} (i \neq j \rightarrow a_{1i} \neq 0)]$$

or

$$\exists j [j \in \{1, \dots, n\} \wedge a_{1j} = 0 \wedge \forall i ((i \in \{1, \dots, n\} \wedge a_{1i} = 0) \rightarrow i = j)]$$

or

$$\exists j [j \in \{1, \dots, n\} \wedge a_{1j} = 0 \wedge \forall i ((i \in \{1, \dots, n\} \wedge i \neq j) \rightarrow a_{1i} \neq 0)]$$

2. (a)

$$\neg \exists x [x \notin A \wedge x \in B]$$

or

$$\neg \exists x [\neg(x \in A) \wedge x \in B]$$

(b)

$$\forall x \in \mathcal{U} \exists i \in I [x \in A_i]$$

or

$$\forall x [x \in \mathcal{U} \rightarrow (\exists i (i \in I \wedge x \in A_i))]$$