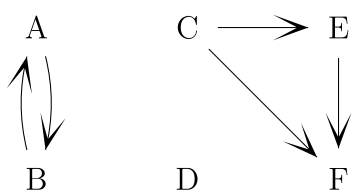
CS 173, Spring 18 Examlet 4, Part B

Name:____

NetID:____________________ **Lecture:** **A** **B**

Discussion: **Thursday** **Friday** **9** **10** **11** **12** **1** **2** **3** **4** **5** **6**

1. (5 points) Check all boxes that correctly characterize this relation on the set $\{A, B, C, D, E, F\}$.



Reflexive: ☐ Irreflexive: ☐

Symmetric: ☐ Antisymmetric: ☐

Transitive: ☐

2. (5 points) Recall that $\mathbb{N}^2$ is the set of all pairs of natural numbers. Let's define the equivalence relation $\sim$ on $\mathbb{N}^2$ as follows: $(x, y) \sim (p, q)$ if and only $|x - y| = |p - q|$. List three members of $[(2, 3)]$.

3. (5 points) Suppose that R is a relation on the integers such xRy if and only if $x = y$. Is R an equivalence relation?

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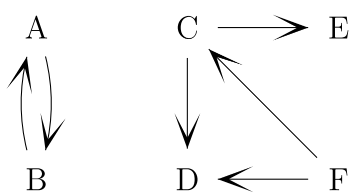

Reflexive: ☐ Irreflexive: ☐

Symmetric: ☐ Antisymmetric: ☐

Transitive: ☐

2. (5 points) Can a relation be symetric and also antisymmetric? Either give such a relation or briefly explain why it's not possible to construct one.

3. (5 points) Let J be the set of open intervals of the real line, i.e $J = \{(x, y) \in \mathbb{R}^2 \mid x < y\}$. Let's define the "disjoint" relation D on J by $(a, b)D(c, d)$ if and only if $b \leq c$ or $d \leq a$. Is D transitive? Informally explain why it is, or give a concrete counter-example showing that it is not.

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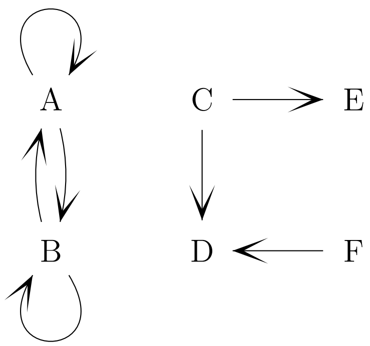

Reflexive: ☐ Irreflexive: ☐

Symmetric: ☐ Antisymmetric: ☐

Transitive: ☐

2. (5 points) Suppose that R is a partial order on a set A. What additional property is required for R to be a linear order (aka total order)? Give specific details of the property, not just its name.

3. (5 points) Suppose that R is a relation on the integers such xRy if and only if $2 \mid (x + y + 1)$. Is R transitive?

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1. (5 points) Check all boxes that correctly characterize this relation on the set $\{A, B, C, D, E, F\}$.

A C E

B D F

(that is, 6 nodes and no arrows at all)

Reflexive: ☐ Irreflexive: ☐

Symmetric: ☐ Antisymmetric: ☐

Transitive: ☐

2. (5 points) Let R be the equivalence relation on the real numbers such that xRy if and only if $\lfloor x \rfloor = \lfloor y \rfloor$. Give three members of the equivalence class $[13]$.

3. (5 points) Suppose that R is a relation on pairs of integers such that $(x, y)R(a, b)$ if and only if $x - a \geq 2$ and $y \geq b$. Is R a partial order?

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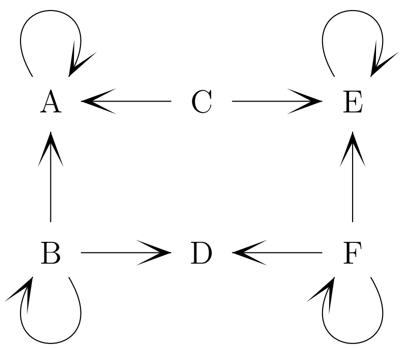
1. (5 points) Check all boxes that correctly characterize this relation on the set $\{A, B, C, D, E, F\}$.



Reflexive: ☐ Irreflexive: ☐

Symmetric: ☐ Antisymmetric: ☐

Transitive: ☐

2. (5 points) **Notice that this problem was corrected early in the exam. This is the corrected version.** Let's define the relation $\sim$ on $\mathbb{Z}$ sucn that $x \sim y$ if and only $|x - y| = 3$. List all elements related to 7.

3. (5 points) Let S be the relation defined on set of pairs $(x, y) \in \mathbb{R}^2$ such that $(x, y)S(p, q)$ if and only if $x^2 + y^2 \leq p^2 + q^2$. Is S antisymmetric? Informally explain why it is, or give a concrete counter-example showing that it is not.

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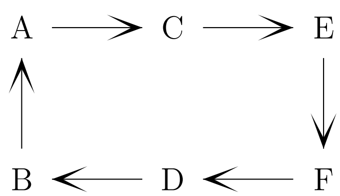
1. (5 points) Check all boxes that correctly characterize this relation on the set $\{A, B, C, D, E, F\}$.



Reflexive: ☐ Irreflexive: ☐

Symmetric: ☐ Antisymmetric: ☐

Transitive: ☐

2. (5 points) Suppose that R is an equivalence relation on a set A. Using precise set notation, define $[x]_R$, i.e. the equivalence class of x under the relation R.

3. (5 points) Let J be the set of open intervals of the real line, i.e $J = \{(x, y) \in \mathbb{R}^2 \mid x < y\}$. Let's define the "touches" relation T on J by $(a, b)T(c, d)$ if and only if $a = d$ or $b = c$. Is T transitive? Informally explain why it is, or give a concrete counter-example showing that it is not.