Assingment1

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Question

Find the max-product and max-min composition of relations R1 and

R2 given as follows: R1 =
$$\begin{vmatrix} 1.0 & 0.3 & 0.9 & 0.0 \\ 0.3 & 1.0 & 0.8 & 1.0 \\ 0.9 & 0.8 & 1.0 & 0.8 \\ 0.0 & 1.0 & 0.8 & 1.0 \end{vmatrix}$$
 and R2 =
$$\begin{vmatrix} 1.0 & 1.0 & 0.9 \\ 1.0 & 0.0 & 0.5 \\ 0.3 & 0.1 & 0.0 \\ 0.2 & 0.3 & 0.1 \end{vmatrix}$$

Solution

Given R1 =
$$\begin{vmatrix} 1.0 & 0.3 & 0.9 & 0.0 \\ 0.3 & 1.0 & 0.8 & 1.0 \\ 0.9 & 0.8 & 1.0 & 0.8 \\ 0.0 & 1.0 & 0.8 & 1.0 \end{vmatrix}$$
 and R2 =
$$\begin{vmatrix} 1.0 & 1.0 & 0.9 \\ 1.0 & 0.0 & 0.5 \\ 0.3 & 0.1 & 0.0 \\ 0.2 & 0.3 & 0.1 \end{vmatrix}$$

1 Max-Product

$$\begin{split} \mu T(x1,z1) &= max((1.0*1.0),(0.3*1.0),(0.9*0.3),(0.0*0.2))\\ \mu T(x1,z1) &= max(1.0,0.3,0.27,0.0)\\ \mu T(x1,z1) &= 1.0 \end{split}$$

$$\begin{split} &\mu T(x1,z2) = max((1.0*1.0),(0.3*0.0),(0.9*0.1),(0.0*0.3))\\ &\mu T(x1,z2) = max(1.0,0.0,0.09,0.0)\\ &\mu T(x1,z2) = 1.0\\ &\mu T(x1,z3) = max((1.0*0.9),(0.3*0.5),(0.9*0.0),(0.0*0.1))\\ &\mu T(x1,z3) = max(0.9,0.15,0.0,0.0)\\ &\mu T(x1,z3) = 0.15\\ &\mu T(x2,z1) = max((0.3*1.0),(1.0*1.0),(0.8*0.3),(1.0*0.2))\\ &\mu T(x2,z1) = max(0.3,1.0,0.24,0.2)\\ &\mu T(x2,z1) = 1.0\\ &\mu T(x2,z2) = max((0.3*1.0),(1.0*0.0),(0.8*0.1),(1.0*0.3))\\ &\mu T(x2,z2) = max(0.3,0.0,0.08,0.3)\\ &\mu T(x2,z2) = 0.3\\ &\mu T(x2,z3) = max((0.3*0.9),(1.0*0.5),(0.8*0.0),(1.080.1))\\ &\mu T(x2,z3) = max(0.27,0.5,0.0,0.1)\\ &\mu T(x3,z1) = max((0.9*1.0),(0.8*1.0),(1.0*0.3),(0.8*0.2))\\ &\mu T(x3,z1) = max(0.9,0.8,0.3,0.16)\\ &\mu T(x3,z2) = max((0.9*1.0),(0.8*0.0),(1.0*0.1),(0.8*0.3))\\ &\mu T(x3,z2) = max(0.9,0.0,0.1,0.24)\\ &\mu T(x3,z2) = max(0.9,0.0,0.1,0.24)\\ &\mu T(x3,z2) = 0.24\\ \end{split}$$

$$\begin{split} \mu T(x3,z3) &= max((0.9*0.9), (0.8*0.5), (1.0*0.0), (0.8*0.1)) \\ \mu T(x3,z3) &= max(0.81,0.40,0.0,0.08) \\ \mu T(x3,z3) &= 0.81 \end{split}$$

$$\begin{split} \mu T(x4,z1) &= max((0.0*1.0), (1.0*1.0), (0.8*0.3), (1.0*0.2)) \\ \mu T(x4,z1) &= max(0.0,1.0,0.24,0.2) \\ \mu T(x4,z1) &= 1.0 \end{split}$$

$$\begin{split} \mu T(x4,z2) &= max((0.0*1.0), (1.0*0.0), (0.8*0.1), (1.0*0.3)) \\ \mu T(x4,z2) &= max(0.0,0.0,0.08,0.3) \\ \mu T(x4,z2) &= 0.3 \end{split}$$

$$\mu T(x4,z3) &= max((0.0*0.9), (1.0*0.5), (0.8*0.0), (1.0*0.1)) \end{split}$$

Hence

 $\mu T(x4, z3) = 0.5$

$$\label{eq:max_product} \text{Max Product , T = R1 . R2} = \begin{vmatrix} 1.0 & 1.0 & 0.15 \\ 1.0 & 0.3 & 0.27 \\ 0.16 & 0.24 & 0.81 \\ 1.0 & 0.3 & 0.5 \\ \end{vmatrix}$$

2 Max-Min Composition

 $\mu T(x4, z3) = max(0.0, 0.5, 0.0, 0.1)$

Now,

$$\begin{split} \mu T(x1,z1) &= max(min(1.0,1.0),min(0.3,1.0),min(0.9,0.3),min(0.0,0.2))\\ \mu T(x1,z1) &= max(1.0,0.3,0.3,0.0)\\ \mu T(x1,z1) &= 1.0 \end{split}$$

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\mu T(x1, z2) = max(min(1.0, 1.0), min(0.3, 0.0), min(0.9, 0.1), min(0.0, 0.3))
\mu T(x1, z2) = max(1.0, 0.0, 0.1, 0.0)
\mu T(x1, z2) = 1.0
\mu T(x1, z3) = max(min(1.0, 0.9), min(0.3, 0.5), min(0.9, 0.0), min(0.0, 0.1))
\mu T(x1, z3) = max(0.9, 0.3, 0.0, 0.0)
\mu T(x1, z3) = 0.9
\mu T(x2, z1) = max(min(0.3, 1.0), min(1.0, 1.0), min(0.8, 0.3), min(1.0, 0.2))
\mu T(x2, z1) = max(0.3, 1.0, 0.3, 0.2)
\mu T(x2, z1) = 1.0
\mu T(x2, z2) = max(min(0.3, 1.0), min(1.0, 0.0), min(0.8, 0.1), min(1.0, 0.3))
\mu T(x2, z2) = max(0.3, 0.0, 0.1, 0.3)
\mu T(x2, z2) = 0.3
\mu T(x2, z3) = max(min(0.3, 0.9), min(1.0, 0.5), min(0.8, 0.0), min(1.0, 0.1))
\mu T(x2, z3) = max(0.3, 0.5, 0.0, 0.1)
\mu T(x2, z3) = 0.5
\mu T(x3, z1) = max(min(0.9, 1.0), min(0.8, 1.0), min(1.0, 0.3), min(0.8, 0.2))
\mu T(x3, z1) = max(0.9, 0.8, 0.3, 0.2)
\mu T(x3, z1) = 0.9
\mu T(x3, z2) = max(min(0.9, 1.0), min(0.8, 0.0), min(1.0, 0.1), min(0.8, 0.3))
\mu T(x3, z2) = max(0.9, 0.0, 0.1, 0.3)
\mu T(x3, z2) = 0.9
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$$\begin{split} \mu T(x3,z3) &= \max(\min(0.9,0.9), \min(0.8,0.5), \min(1.0,0.0), \min(0.8,0.1)) \\ \mu T(x3,z3) &= \max(0.9,0.5,0.0,0.1) \\ \mu T(x3,z3) &= 0.9 \\ \\ \mu T(x4,z1) &= \max(\min(0.0,1.0), \min(1.0,1.0), \min(0.8,0.3), \min(1.0,0.2)) \\ \mu T(x4,z1) &= \max(0.0,1.0,0.3,0.2) \\ \mu T(x4,z1) &= 1.0 \\ \\ \mu T(x4,z2) &= \max(\min(0.0,1.0), \min(1.0,0.0), \min(0.8,0.1), \min(1.0,0.3)) \\ \mu T(x4,z2) &= \max(0.0,0.0,0.1,0.3) \\ \mu T(x4,z2) &= 0.3 \\ \\ \mu T(x4,z3) &= \max(\min(0.0,0.9), \min(1.0,0.5), \min(0.8,0.0), \min(1.0,0.1)) \\ \mu T(x4,z3) &= \max(0.0,0.5,0.0,0.1) \\ \mu T(x4,z3) &= 0.5 \end{split}$$

Hence

Max Min Composition , T = R1 . R2 =
$$\begin{vmatrix} 1.0 & 1.0 & 0.9 \\ 1.0 & 0.3 & 0.5 \\ 0.9 & 0.9 & 0.9 \\ 1.0 & 0.3 & 0.5 \end{vmatrix}$$