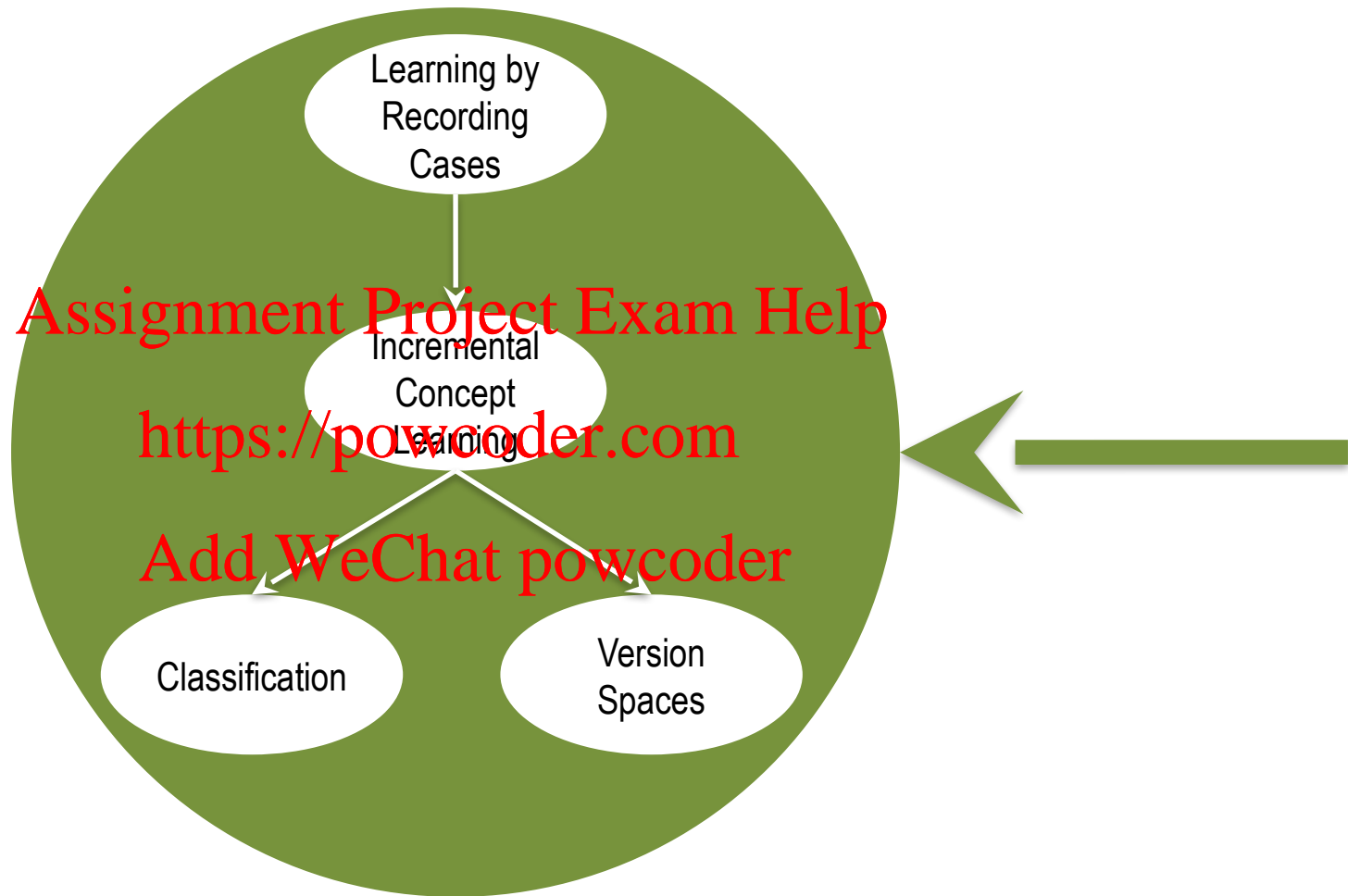


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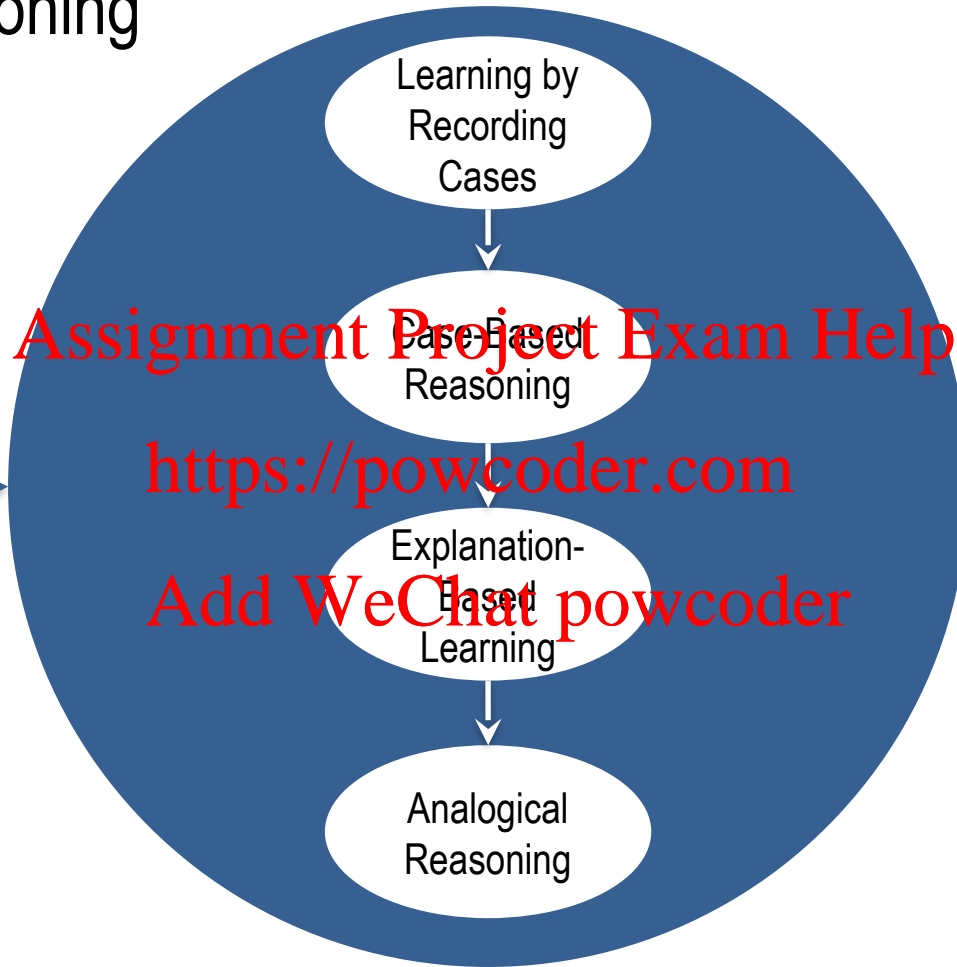
Learning by  
<https://powcoder.com>  
Recording

Cases  
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# Learning



# Analogical Reasoning



# Lesson Preview

- Learning by recording cases
- Nearest neighbor method
- Cases in the real world
- k-Nearest Neighbor

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Block World

Red

Orange

Blue

Black

<https://powcoder.com>

Green

Add WeChat powcoder

Purple

Block World

Red

Orange

Blue

Black

<https://powcoder.com>

Green

Add WeChat powcoder

Purple

What color is this block?

?

Block World

Red

Orange

Blue

Black

<https://powcoder.com>

Green

Add WeChat powcoder

Purple

Black

What color is this block?

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Given new problem **a**



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Retrieve most similar prior problem, **b**, from memory



Apply **b**'s solution to problem **a**



## Block World

Red

Orange

Blue

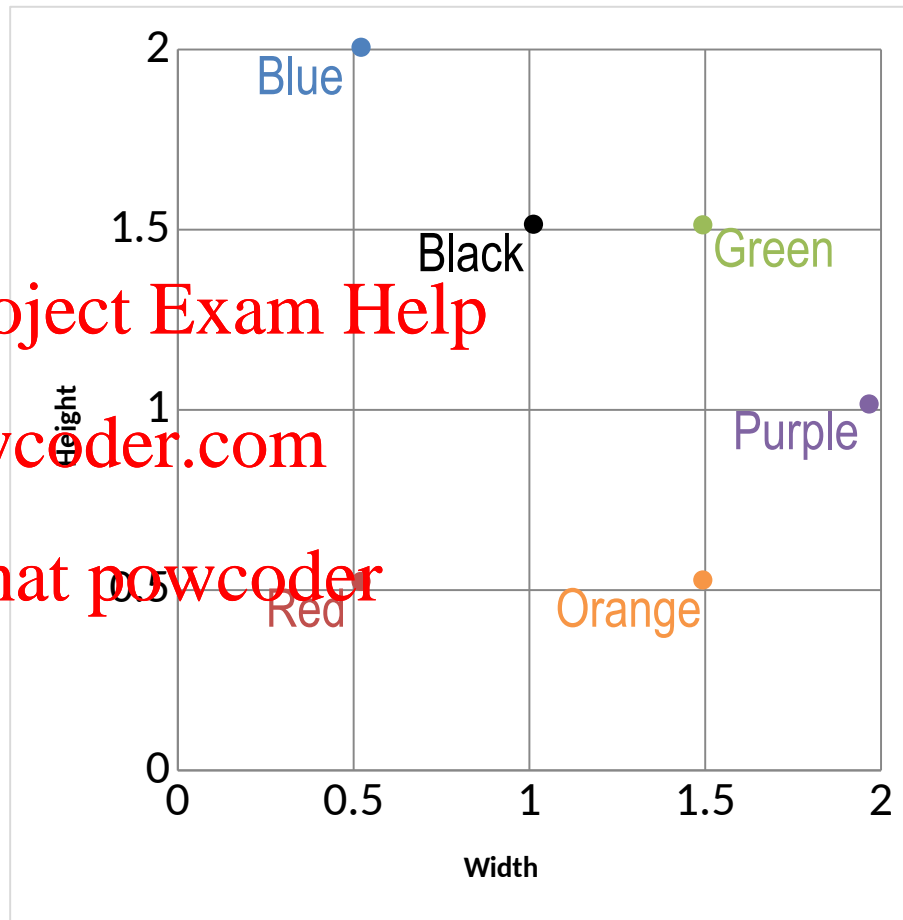
Black

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Green

Purple



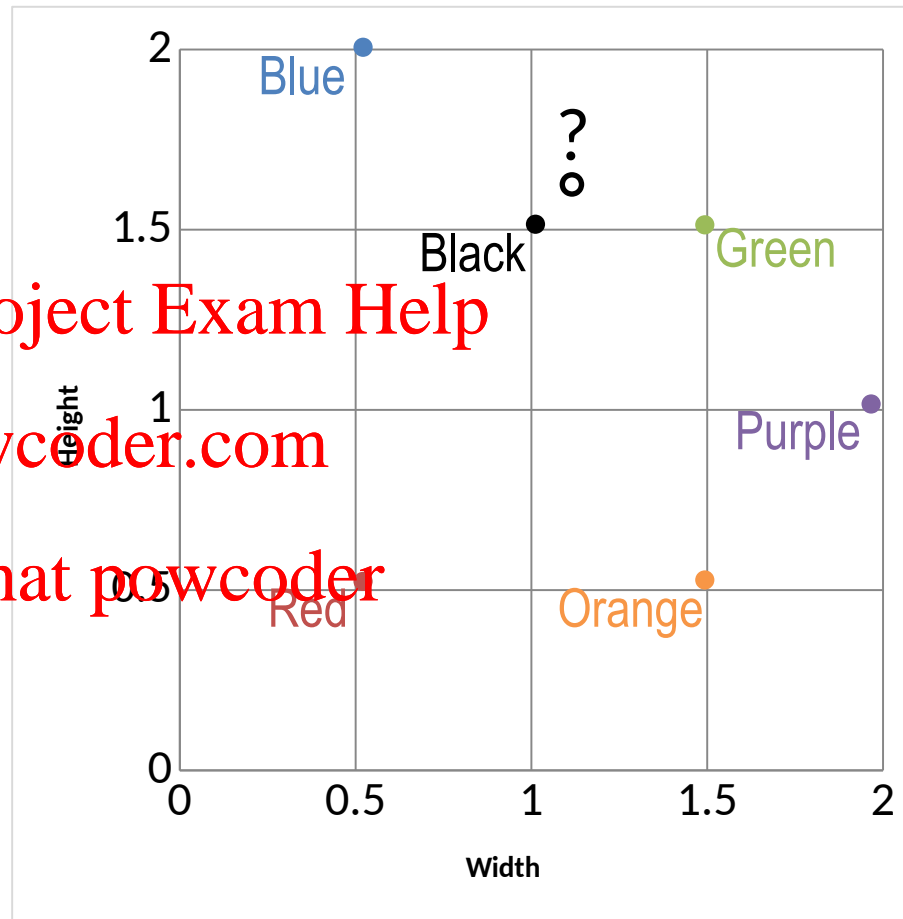
What color is this block?



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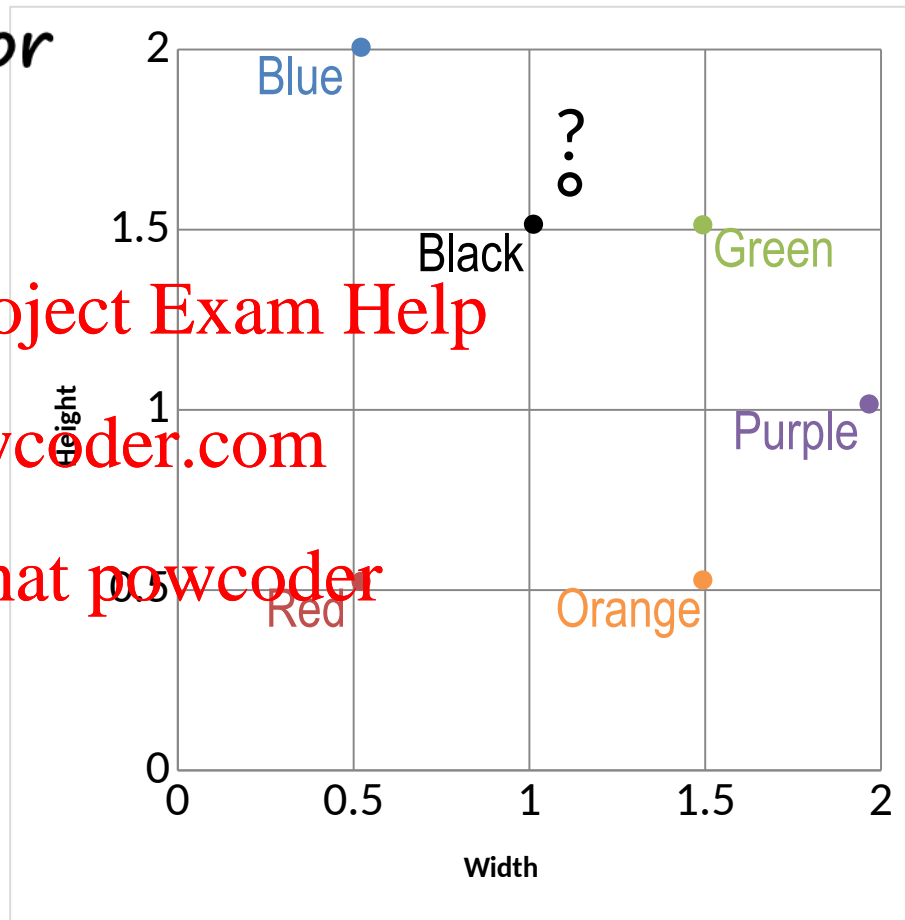
# Finding the Nearest Neighbor

Given existing case at  $(x_c, y_c)$   
and new problem at  $(x_n, y_n)$

$$d = \sqrt{(y_c - y_n)^2 + (x_c - x_n)^2}$$

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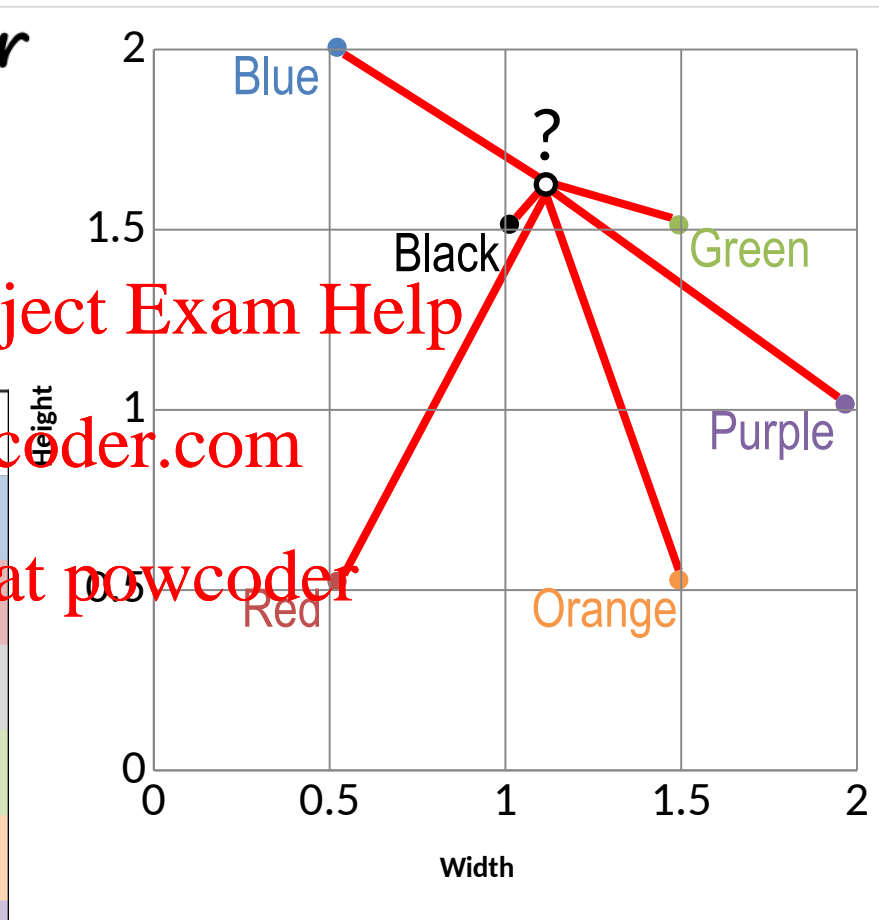


# Finding the Nearest Neighbor

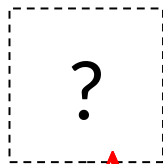
Given existing case at  $(x_c, y_c)$   
and new problem at  $(x_n, y_n)$

$$d = \sqrt{(y_c - y_n)^2 + (x_c - x_n)^2}$$

Block	$x_c$	$y_c$	$x_n$	$y_n$	$d$
Blue	0.5	2.0	1.1	1.6	0.72
Red	0.5	0.5	1.1	1.6	1.25
<b>Black</b>	<b>1.0</b>	<b>1.5</b>	<b>1.1</b>	<b>1.6</b>	<b>0.14</b>
Green	1.5	1.5	1.1	1.6	0.41
Orange	1.5	0.5	1.1	1.6	1.17
Purple	2.0	1.0	1.1	1.6	1.08



What color is this block?



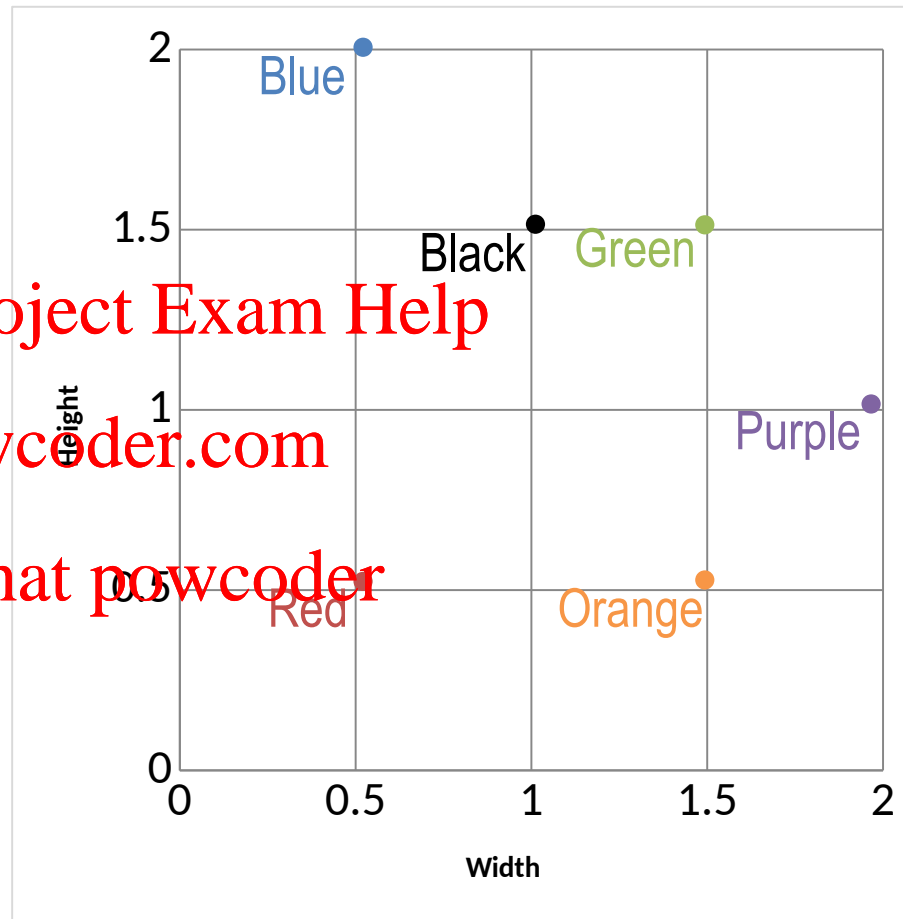
Width = 0.8

Height = 0.8

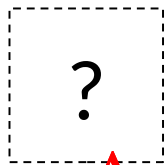
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What color is this block?

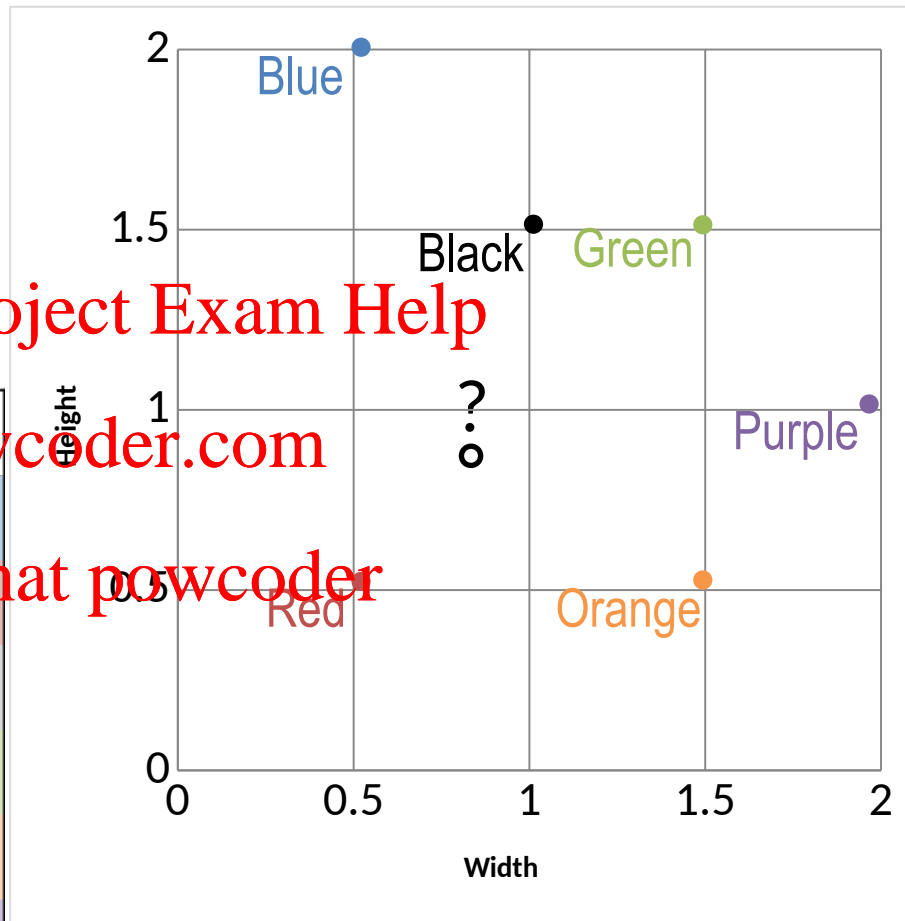


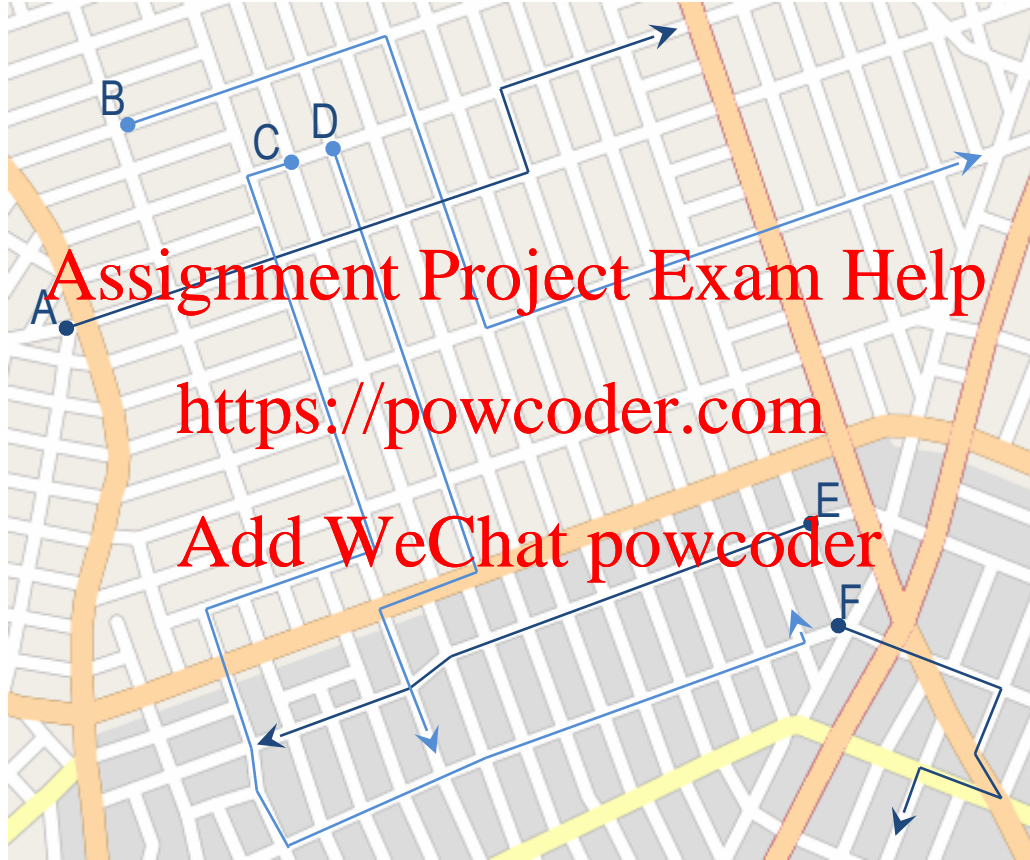
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Block	$x_c$	$y_c$	$x_n$	$y_n$	$d$
Blue	0.5	2.0	0.8	0.8	1.24
Red	0.5	0.5	0.8	0.8	0.42
Black	1.0	1.5	0.8	0.8	0.72
Green	1.5	1.5	0.8	0.8	0.98
Orange	1.5	0.5	0.8	0.8	0.76
Purple	2.0	1.0	0.8	0.8	1.22





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What route is most similar to this new problem?

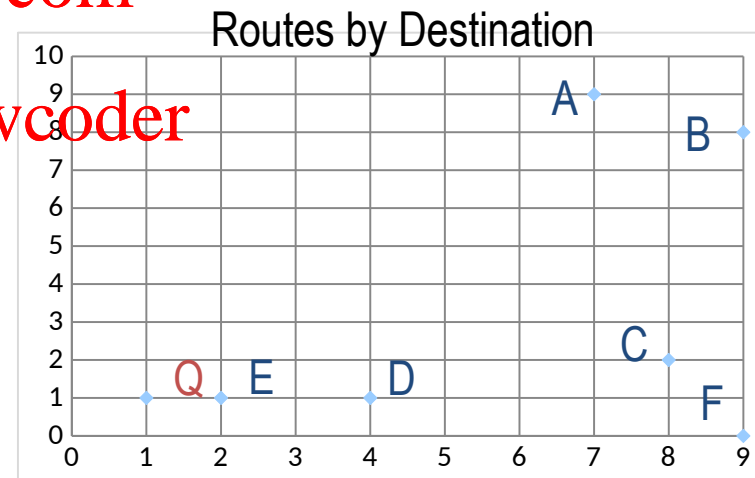
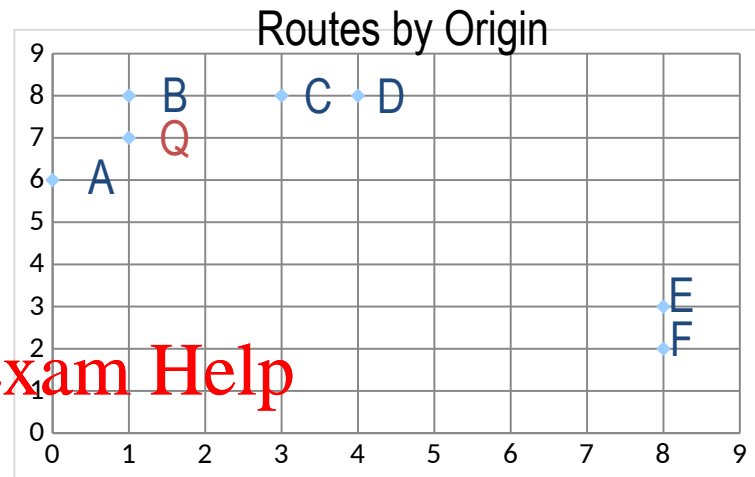




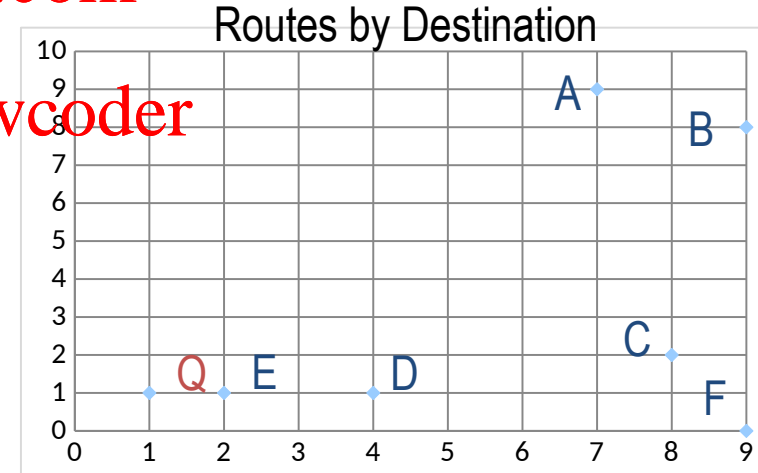
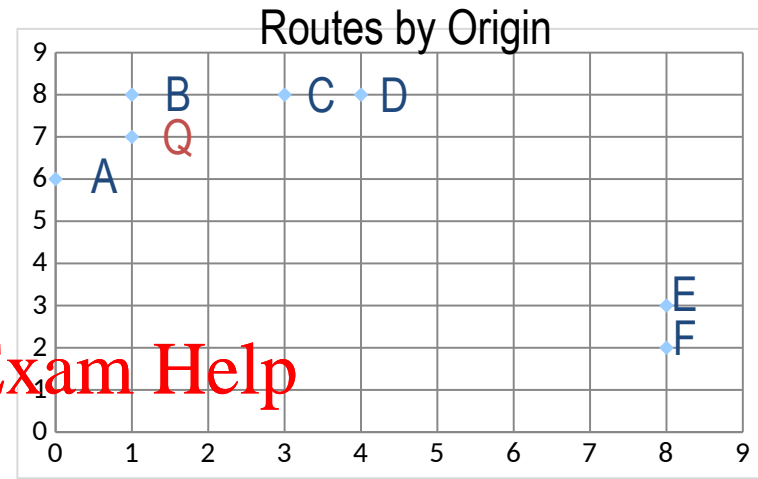
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Route	Origin			Destination		
	$x_o$	$y_o$	$d_o$	$x_d$	$y_d$	$d_d$
A	0	6	1.41	7	9	10.00
B	1	8	1.00	9	8	10.63
C	3	8	2.24	8	2	7.67
D	4	8	3.16	4	1	3.00
E	8	3	8.06	2	1	1.00
F	8	2	8.60	9	0	8.06
Q	1	7	-	1	1	-



# Finding the Nearest Neighbor

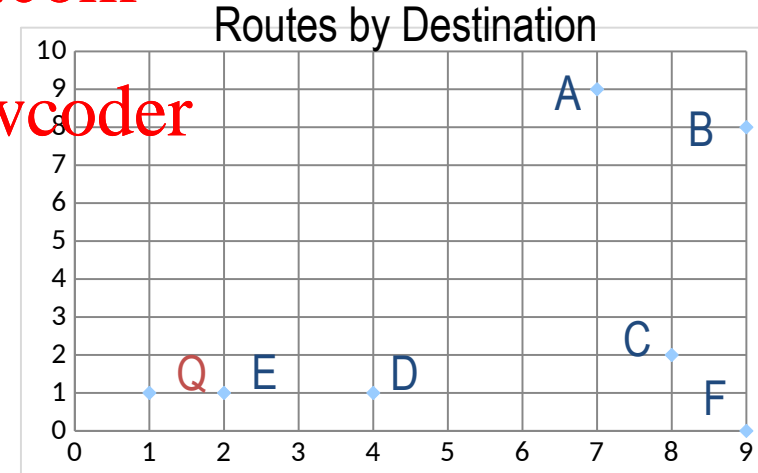
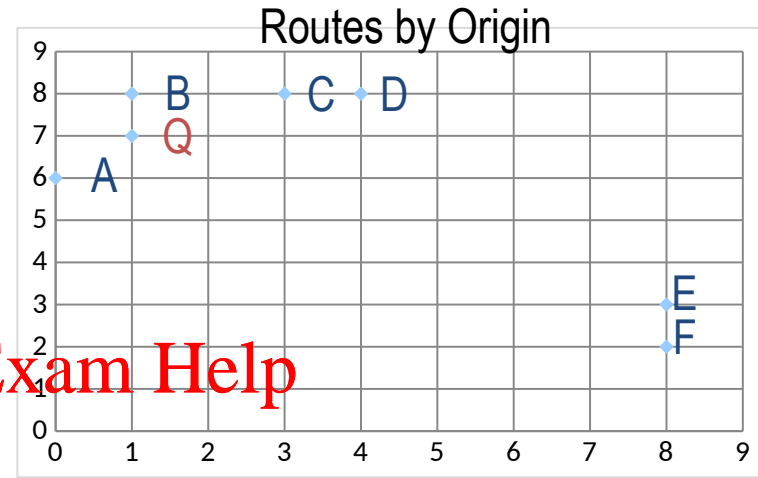
Given existing case at  $(x_c, y_c)$   
and new problem at  $(x_n, y_n)$

$$d = \sqrt{(y_c - y_n)^2 + (x_c - x_n)^2}$$

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# Finding the Nearest Neighbor

Given existing case at  $(x_c, y_c)$   
and new problem at  $(x_n, y_n)$

$$d = \sqrt{(y_c - y_n)^2 + (x_c - x_n)^2}$$

Assignment Project Exam Help

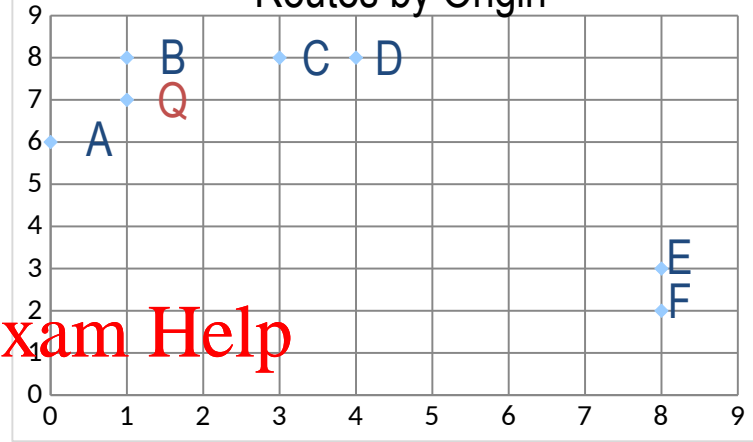
<https://powcoder.com>

Given existing case at  $(c_1, c_2, \dots, c_k)$   
and new problem at  $(p_1, p_2, \dots, p_k)$

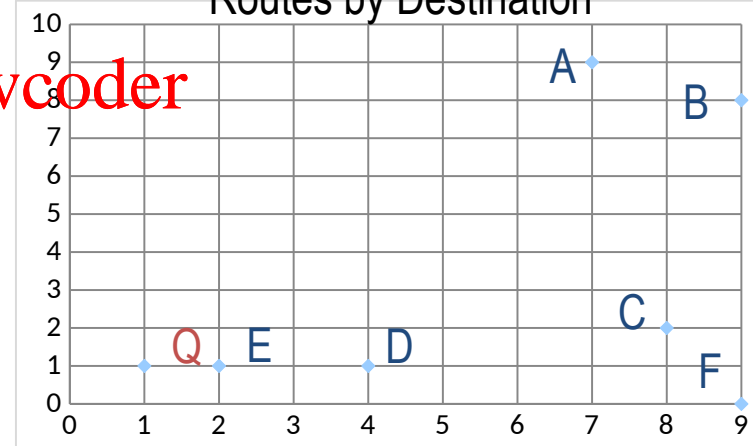
$$d = \sqrt{\sum_{i=1}^k (c_i - p_i)^2}$$

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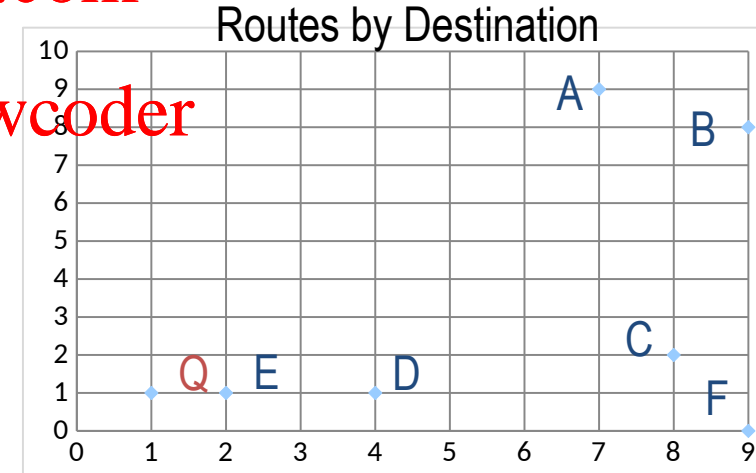
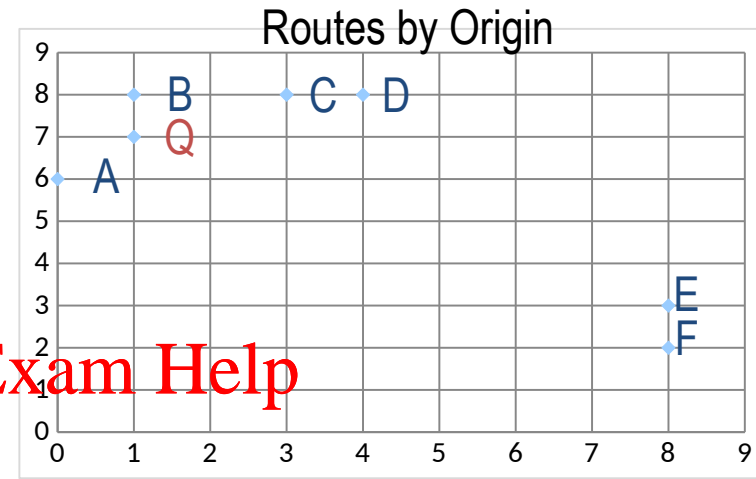
Routes by Origin



Routes by Destination



Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_k$
A	0	6	7	9	10.10
B	1	8	9	8	10.58
C	3	8	8	2	7.42
D	4	8	4	1	4.36
E	8	3	2	1	3.42
F	8	2	9	0	11.80
Q	1	7	1	1	-



# **Assignment**

How would you use recording cases to design an agent that could answer Raven's Progressive Matrices?

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## To recap...

- Recording and using cases
  - Nearest neighbor method
  - Cases in real-world problems
  - Nearest neighbor in k-dimensional problems
- Assignment Project Exam Help
- <https://powcoder.com>
- Add WeChat powcoder

# Finding the Nearest Neighbor

Given existing case at (  
and new problem at (

Block					
Blue	0.5	2.0	1.1	1.6	0.72
Red	0.5	0.5	1.1	1.6	1.25
Black	1.0	1.5	1.1	1.6	0.14
Green	1.5	1.5	1.1	1.6	0.41
Orange	1.5	0.5	1.1	1.6	1.17
Purple	2.0	1.0	1.1	1.6	1.08

Block

Blue	0.5	2.0	1.1	1.6	0.72
Red	0.5	0.5	1.1	1.6	1.25
Black	1.0	1.5	1.1	1.6	0.14
Green	1.5	1.5	1.1	1.6	0.41
Orange	1.5	0.5	1.1	1.6	1.17
Purple	2.0	1.0	1.1	1.6	1.08
Blue	0.5	2.0	0.8	0.8	1.24
Red	0.5	0.5	0.8	0.8	0.42
Black	1.0	1.5	0.8	0.8	0.72
Green	1.5	1.5	0.8	0.8	0.98
Orange	1.5	0.5	0.8	0.8	0.76
Purple	2.0	1.0	0.8	0.8	1.22

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Block	x <sub>1</sub>	y <sub>1</sub>	x <sub>2</sub>	y <sub>2</sub>	d	Block	x <sub>1</sub>	y <sub>1</sub>	x <sub>2</sub>	y <sub>2</sub>	d	Block	x <sub>1</sub>	y <sub>1</sub>	x <sub>2</sub>	y <sub>2</sub>	d	Block	x <sub>1</sub>	y <sub>1</sub>	x <sub>2</sub>	y <sub>2</sub>	d	Block	x <sub>1</sub>	y <sub>1</sub>	x <sub>2</sub>	y <sub>2</sub>	d
Blue	0.5	2.0	1.1	1.6	0.72	Blue	0.5	2.0	1.1	1.6	0.72	Blue	0.5	2.0	1.1	1.6	0.72	Blue	0.5	2.0	1.1	1.6	0.72	Blue	0.5	2.0	1.1	1.6	0.72
Red	0.5	0.5	1.1	1.6	1.25	Red	0.5	0.5	1.1	1.6	1.25	Red	0.5	0.5	1.1	1.6	1.25	Red	0.5	0.5	1.1	1.6	1.25	Red	0.5	0.5	1.1	1.6	1.25
Black	1.0	1.5	1.1	1.6	0.14	Black	1.0	1.5	1.1	1.6	0.14	Black	1.0	1.5	1.1	1.6	0.14	Black	1.0	1.5	1.1	1.6	0.14	Black	1.0	1.5	1.1	1.6	0.14
Green	1.5	1.5	1.1	1.6	0.41	Green	1.5	1.5	1.1	1.6	0.41	Green	1.5	1.5	1.1	1.6	0.41	Green	1.5	1.5	1.1	1.6	0.41	Green	1.5	1.5	1.1	1.6	0.41
Orange	1.5	0.5	1.1	1.6	1.17	Orange	1.5	0.5	1.1	1.6	1.17	Orange	1.5	0.5	1.1	1.6	1.17	Orange	1.5	0.5	1.1	1.6	1.17	Orange	1.5	0.5	1.1	1.6	1.17
Purple	2.0	1.0	1.1	1.6	1.08	Purple	2.0	1.0	1.1	1.6	1.08	Purple	2.0	1.0	1.1	1.6	1.08	Purple	2.0	1.0	1.1	1.6	1.08	Purple	2.0	1.0	1.1	1.6	1.08



Route

Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$	Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$	Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$	Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$
A	0	6	7	9	10.10	A	0	6	7	9	10.10	A	0	6	7	9	10.10	A	0	6	7	9	10.10
B	1	8	9	8	10.68	B	1	8	9	8	10.68	B	1	8	9	8	10.68	B	1	8	9	8	10.68
C	3	8	8	2	7.42	C	3	8	8	2	7.42	C	3	8	8	2	7.42	C	3	8	8	2	7.42
D	4	8	4	1	4.36	D	4	8	4	1	4.36	D	4	8	4	1	4.36	D	4	8	4	1	4.36
E	8	3	2	1	8.12	E	8	3	2	1	8.12	E	8	3	2	1	8.12	E	8	3	2	1	8.12
F	8	2	9	0	11.80	F	8	2	9	0	11.80	F	8	2	9	0	11.80	F	8	2	9	0	11.80
Q	1	7	1	1	-	Q	1	7	1	1	-	Q	1	7	1	1	-	Q	1	7	1	1	-

A	0	6	7	9	10.10
B	1	8	9	8	10.68
C	3	8	8	2	7.42
D	4	8	4	1	4.36
E	8	3	2	1	8.12
F	8	2	9	0	11.80
Q	1	7	1	1	-

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Origin

Destination

Route

Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$	Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$	Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$	Route	$c_1$	$c_2$	$c_3$	$c_4$	$d_5$
A	0	6	7	9	10.10	A	0	6	7	9	10.10	A	0	6	7	9	10.10	A	0	6	7	9	10.10
B	1	8	9	8	10.68	B	1	8	9	8	10.68	B	1	8	9	8	10.68	B	1	8	9	8	10.68
C	3	8	8	2	7.42	C	3	8	8	2	7.42	C	3	8	8	2	7.42	C	3	8	8	2	7.42
D	4	8	4	1	4.36	D	4	8	4	1	4.36	D	4	8	4	1	4.36	D	4	8	4	1	4.36
E	8	3	2	1	8.12	E	8	3	2	1	8.12	E	8	3	2	1	8.12	E	8	3	2	1	8.12
F	8	2	9	0	11.80	F	8	2	9	0	11.80	F	8	2	9	0	11.80	F	8	2	9	0	11.80
Q	1	7	1	1	-	Q	1	7	1	1	-	Q	1	7	1	1	-	Q	1	7	1	1	-

A	0	6	1.41	7	10.00
B	1	8	1.00	9	10.63
C	3	8	2.24	8	7.07
D	4	8	3.16	4	3.00
E	8	3	8.06	2	1.00
F	8	2	8.60	9	8.06
Q	1	7	-	1	1

# Finding the Nearest Neighbor

Given existing case at (

and new problem at (

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Route

**Origin**

**Destination**

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Given existing case at (

and new problem at (

Route	Origin	Destination	Distance	Route	Origin	Destination	Distance
A	0	6	1.41	7	9	10.00	
B	1	8	1.00	9	8	10.63	
C	3	8	2.24	8	2	7.07	
D	4	8	3.16	4	1	3.00	
E	8	3	8.06	2	1	1.00	
F	8	2	8.60	9	0	8.06	
Q	1	7	-	1	1	-	