Map Algebra

Kernals

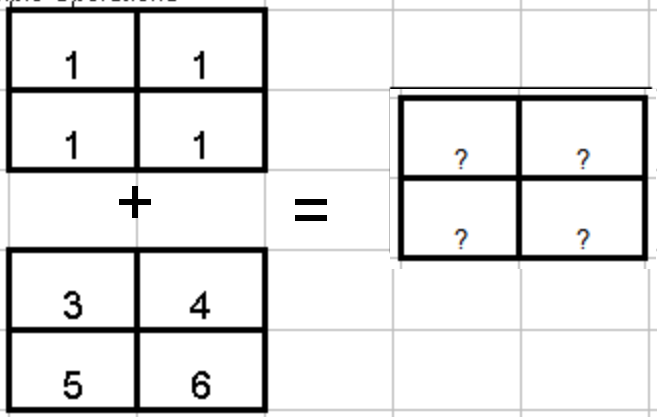
Cost Surface

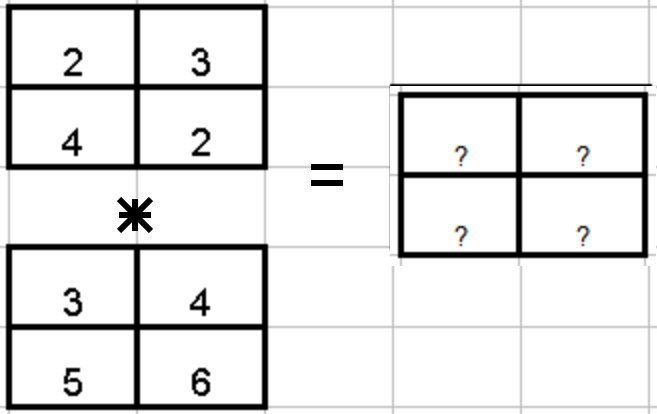
Friction Surface

There will be questions about these on the test

Name: _____

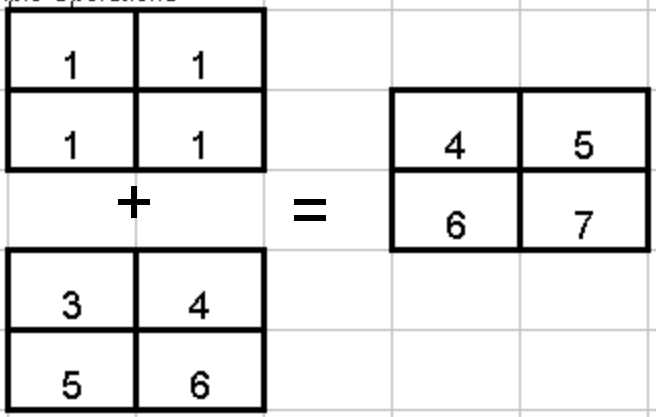
Simple Operations

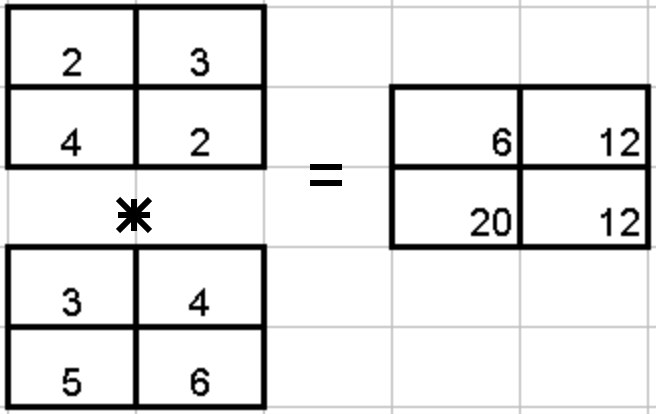


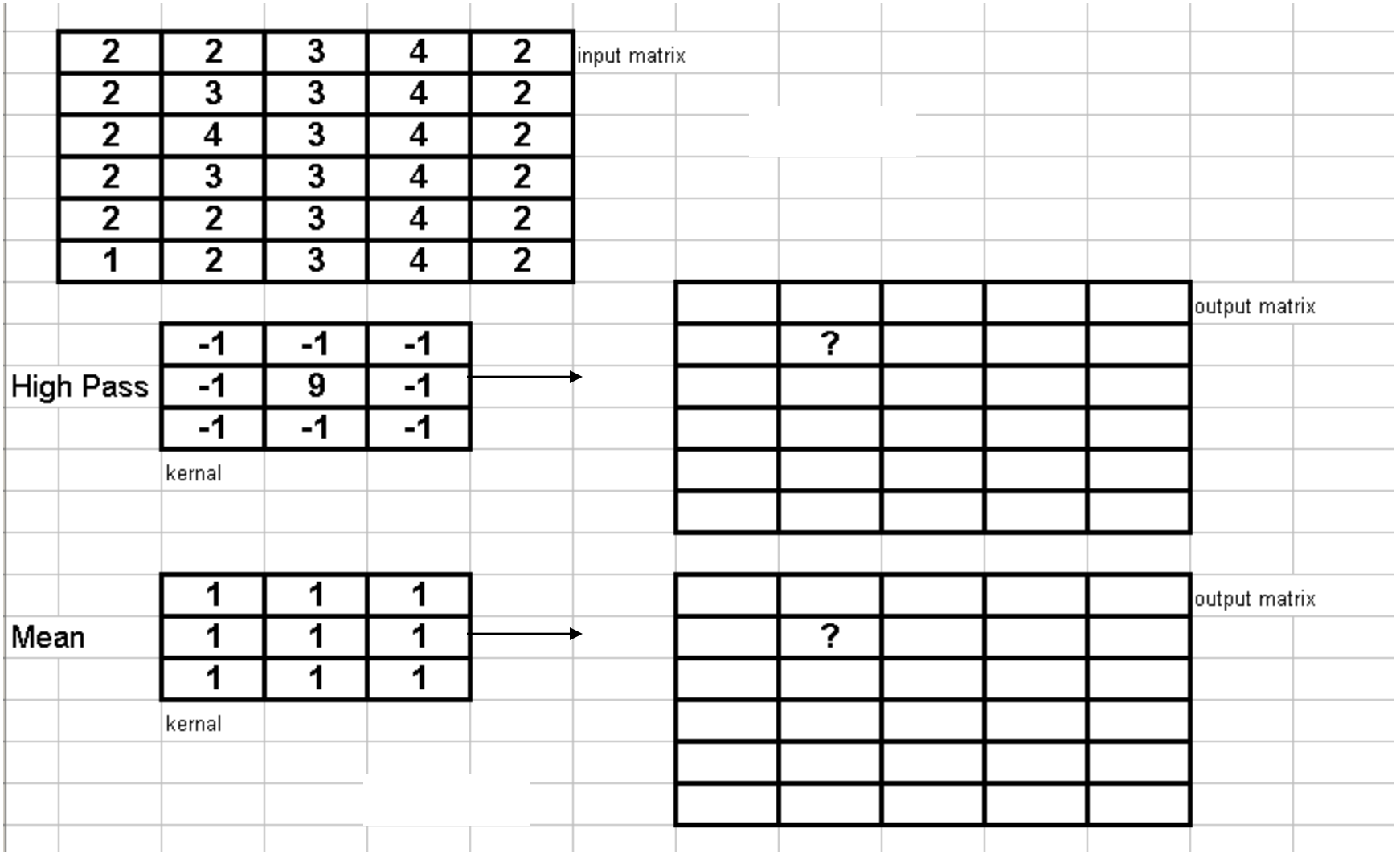


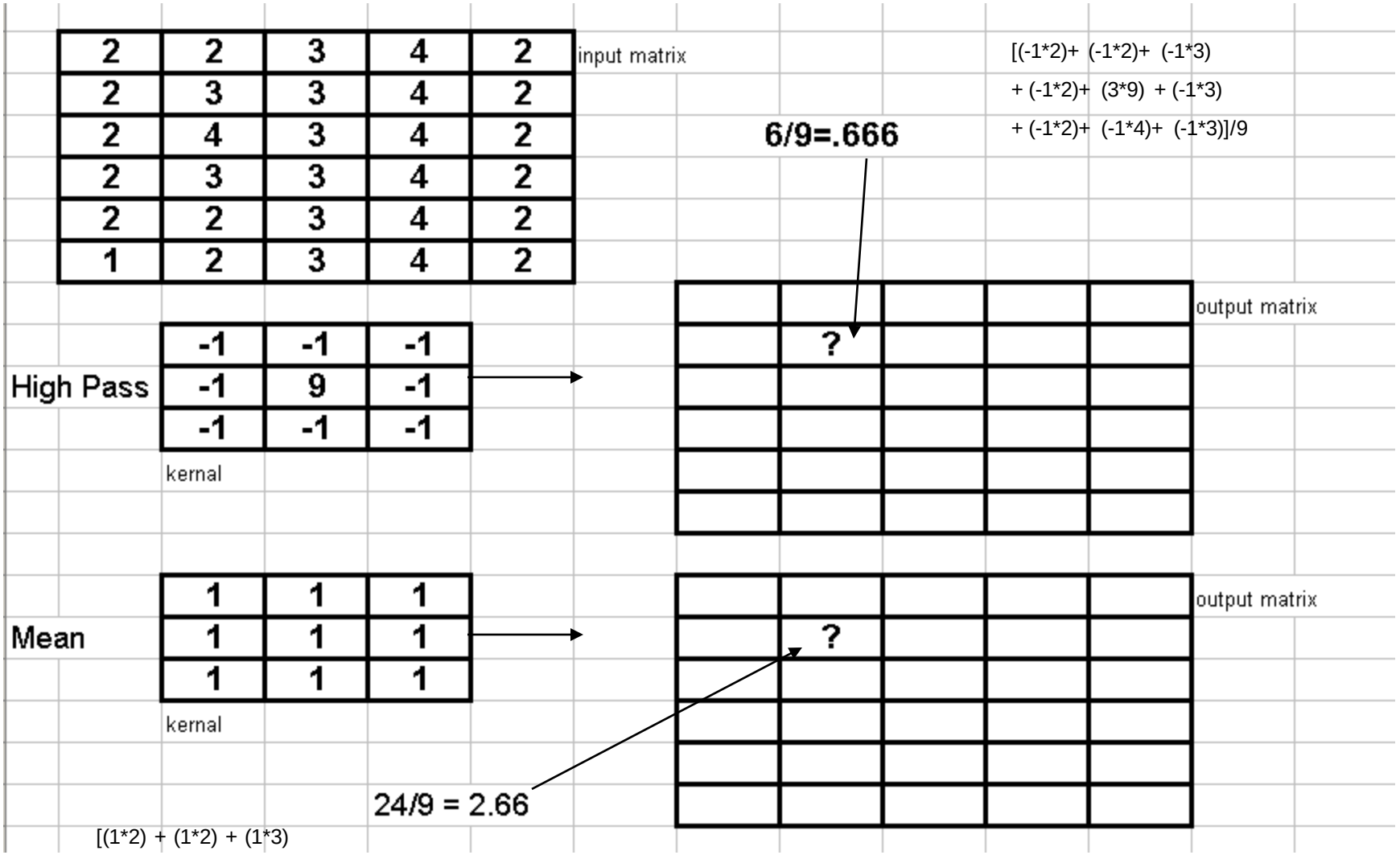
Name: _____

Simple Operations

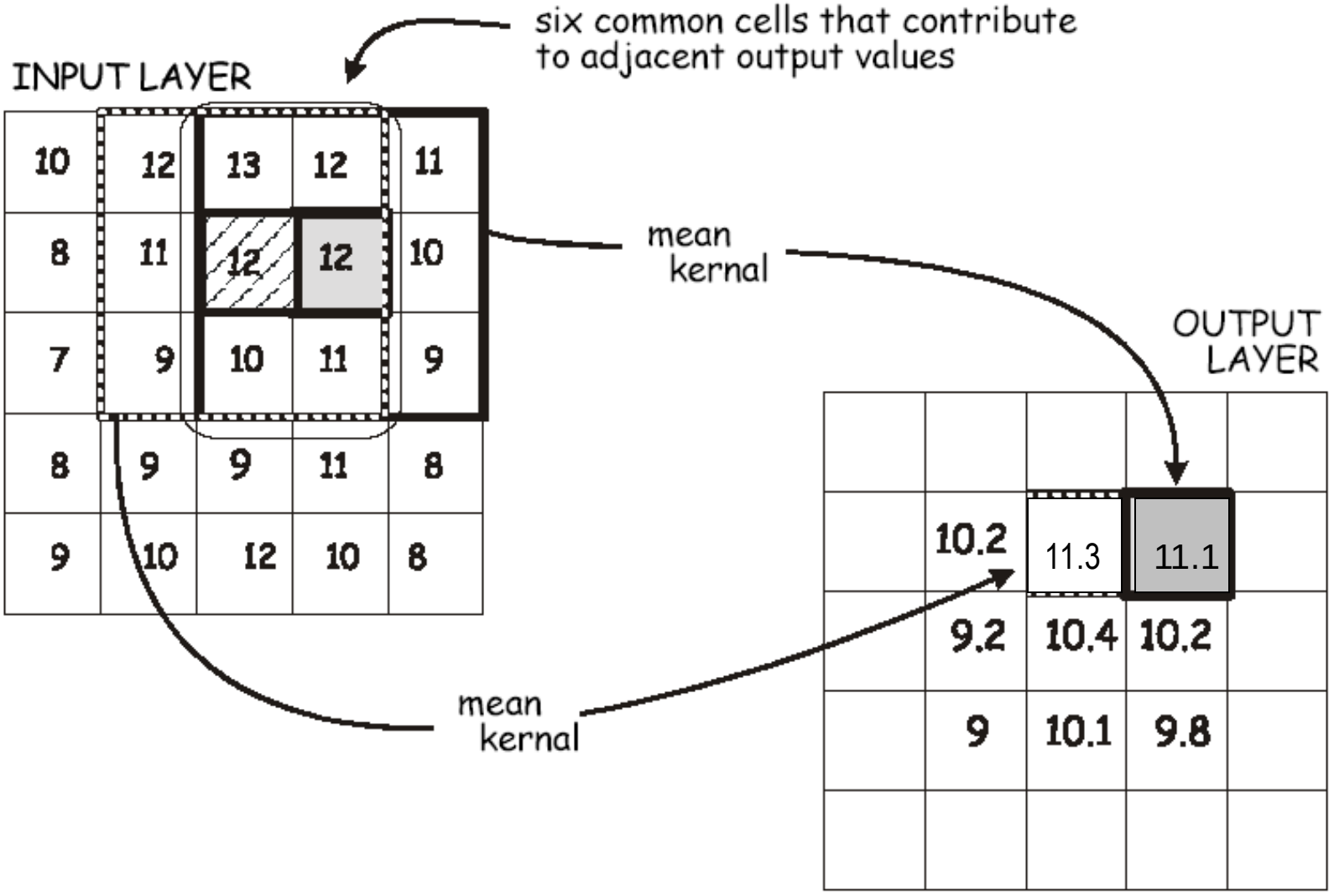


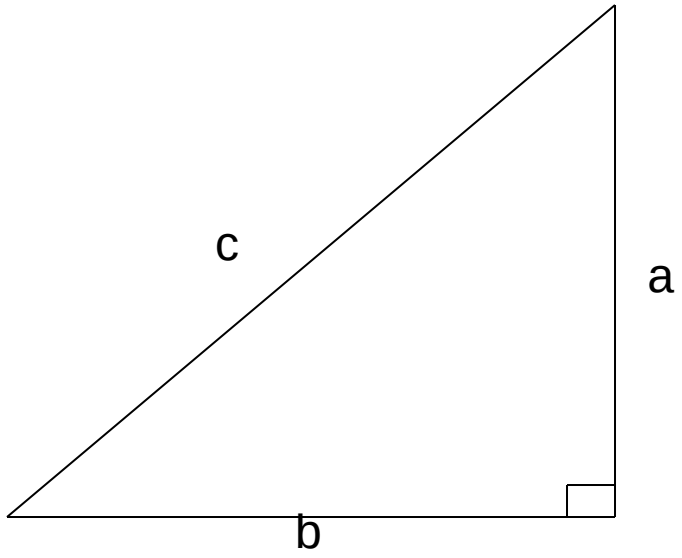



2 2 3 4 2
2 3 3 4 2
2 4 3 4 2
2 3 3 4 2
2 2 3 4 2
1 2 3 4 2
input matrix
High Pass
-1 -1 -1
-1 9 -1
-1 -1 -1
kernal
output matrix
?
Mean
1 1 1
1 1 1
1 1 1
kernal
output matrix
?


2 2 3 4 2
2 3 3 4 2
2 4 3 4 2
2 3 3 4 2
2 2 3 4 2
1 2 3 4 2
input matrix
[(-1*2)+ (-1*2)+ (-1*3)
+ (-1*2)+ (3*9) + (-1*3)
+ (-1*2)+ (-1*4)+ (-1*3)]/9
6/9=.666
output matrix
?
High Pass
-1 -1 -1
-1 9 -1
-1 -1 -1
kernal
output matrix
?
Mean
1 1 1
1 1 1
1 1 1
kernal
24/9 = 2.66
[(1*2) + (1*2) + (1*3)
+(1*2) +(1*3) + (1*3)
+(1*2) + (1*4) + (1*3)]/9

Spatial Covariance:
Consider the effect of adjacent cells





$a^2 + b^2 = c^2$ or $c = \sqrt{(a^2 + b^2)}$

The Pythagorean Theorem

The square of the length of the hypotenuse of a right triangle is equal to the sum of the squares of the legs.

Create a Cost Surface from R1C1
Use formula Distance x factor

Distance x 3

	C1	C2	C3	C4	C5	C6
R1	5	6	7	8	8	8
R2	5	6	8	8	9	9
R3	6	6	7	8	9	10
R4	6	7	7	9	9	10
R5	7	7	7	9	10	10
R6	8	8	8	9	10	10
R7	8	8	8	9	11	10
R8	9	9	9	9	10	10
R9	9	9	9	9	10	10
R10	9	9	10	10	10	11

cell size is 10

Name_____

	C1	C2	C3	C4	C5	C6
R1	source	?	?	?	?	?
R2	?	?	?	?	?	?
R3	?	?	?	?	?	?
R4	?	?	?	?	?	?
R5	?	?	?	?	?	?
R6	?	?	?	?	?	?
R7	?	?	?	?	?	?
R8	?	?	?	?	?	?
R9	?	?	?	?	?	?
R10	?	?	?	?	?	?

From Lecture Notes/Readings

Distance = $\sqrt{(x^2 + y^2)}$

e.g., $D_1 = \sqrt{(20^2 + 10^2)}$

= 22.4

Cost = Distance * fixed cost factor

e.g.

Cost = Distance * 2

20	10	source cell
22.4	14.1	10
28.3	22.4	20

10 units

40	20	source cell
44.8	28.2	20
56.6	44.8	40

Figure 11-13: A cost surface based on a fixed cost per unit distance. Minimum distance from a set of source cells is multiplied by a fixed cost factor to yield a cost surface.

Distance x 3

Formula

$$\sqrt{(a^2 + b^2)} * 3$$

Create a Cost Surface from R1C1

Use formula Distance x factor

Distance x 3

	C1	C2	C3	C4	C5	C6
R1	5	6	7	8	8	8
R2	5	6	8	8	9	9
R3	6	6	7	8	9	10
R4	6	7	7	9	9	10
R5	7	7	7	9	10	10
R6	8	8	8	9	10	10
R7	8	8	8	9	11	10
R8	9	9	9	9	10	10
R9	9	9	9	9	10	10
R10	9	9	10	10	10	11

cell size is 10

For Distance, **Ignore** the cell values

	C1	C2	C3	C4	C5	C6
R1	source	?	?	?	?	?
R2	?	?	?	?	?	?
R3	?	?	?	?	?	?
R4	?	?	?	?	?	?
R5	?	?	?	?	?	?
R6	?	?	?	?	?	?
R7	?	?	?	?	?	?
R8	?	?	?	?	?	?
R9	?	?	?	?	?	?
R10	?	?	?	?	?	?

	C1	C2	C3	C4	C5	C6
R1	source	30	60	90	?	?
R2	30	42.4	67.1	94.9	?	?
R3	60	67.1	84.9	?	?	?
R4	90	94.9	?	?	?	?
R5	120	?	?	?	?	?
R6	?	?	?	?	?	?
R7	?	?	?	?	?	?
R8	?	?	?	?	?	?
R9	?	?	?	?	?	?
R10	?	?	?	?	?	?

cell size is 10

Formula

$$\sqrt{(a^2 + b^2)} * 3$$

From R1C1 to R2C2

$$\sqrt{10^2 + 10^2} * 3$$

14.1 x 3 = 42.4

	C1	C2	C3	C4	C5	C6
R1	5	6	7	8	8	8
R2	5	6	8	8	9	9
R3	6	6	7	8	9	10
R4	6	7	7	9	9	10
R5	7	7	7	9	10	10
R6	8	8	8	9	10	10
R7	8	8	8	9	11	10
R8	9	9	9	9	10	10
R9	9	9	9	9	10	10
R10	9	9	10	10	10	11

cell size is 10

For Friction, **use** the cell values

Friction Surface

	C1	C2	C3	C4	C5	C6
R1	source	?	?			
R2	?	?	?			
R3	?	?				
R4	?					
R5						
R6						
R7						
R8						
R9						
R10						

cell size is 10

From Lecture Notes/Readings

Use a Friction Surface to create travel costs from R1C1

Use formula cell distance x friction

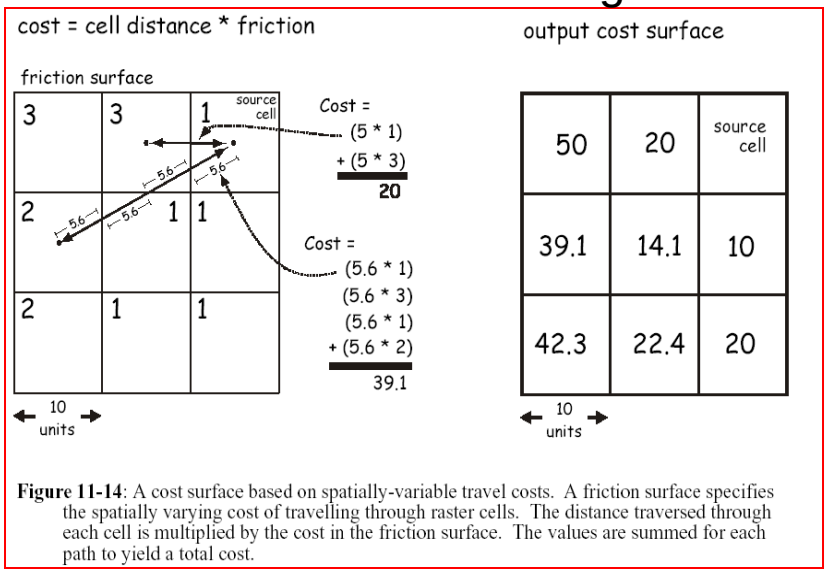


Figure 11-14: A cost surface based on spatially-variable travel costs. A friction surface specifies the spatially varying cost of travelling through raster cells. The distance traversed through each cell is multiplied by the cost in the friction surface. The values are summed for each path to yield a total cost.

	C1	C2	C3	C4	C5	C6
R1	5	6	7	8	8	8
R2	5	6	8	8	9	9
R3	6	6	7	8	9	10
R4	6	7	7	9	9	10
R5	7	7	7	9	10	10
R6	8	8	8	9	10	10
R7	8	8	8	9	11	10
R8	9	9	9	9	10	10
R9	9	9	9	9	10	10
R10	9	9	10	10	10	11

cell size is 10

Friction

Use a Friction Surface to create travel costs from R1C1

Cell by cell distance * friction

Create a Friction Surface from R1C1
Use formula cell distance x friction

	C1	C2	C3	C4	C5	C6
R1	source	55	120	?	?	?
R2	50	77.8	140.0	?	?	?
R3	105	123.2	?	?	?	?
R4	?	?	?	?	?	?
R5	?	?	?	?	?	?
R6	?	?	?	?	?	?
R7	?	?	?	?	?	?
R8	?	?	?	?	?	?
R9	?	?	?	?	?	?
R10	?	?	?	?	?	?

cell size is 10