Map Algebra
Kernals
Cost Surface
Friction Surface

There will be questions about these on the test
Simple Operations

\[
\begin{array}{cc}
1 & 1 \\
1 & 1 \\
\hline
\end{array}\]
\[+\]
\[
\begin{array}{cc}
3 & 4 \\
5 & 6 \\
\hline
\end{array}\]
\[=\]
\[
\begin{array}{cc}
? & ? \\
? & ? \\
\hline
\end{array}\]

\[
\begin{array}{cc}
2 & 3 \\
4 & 2 \\
\hline
\end{array}\]
\[*\]
\[
\begin{array}{cc}
3 & 4 \\
5 & 6 \\
\hline
\end{array}\]
\[=\]
\[
\begin{array}{cc}
? & ? \\
? & ? \\
\hline
\end{array}\]
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* = 20 12
High Pass 

Mean 

Input matrix:

Output matrix:

Kernel:

Output matrix:
\[
\frac{(1 \times 2) + (1 \times 2) + (1 \times 3)}{9} = \frac{6}{9} = 0.666
\]

\[
\frac{(1 \times 2) + (1 \times 3) + (1 \times 3)}{9} = \frac{6}{9} = 0.666
\]

\[
\frac{(1 \times 2) + (1 \times 4) + (1 \times 3)}{9} = \frac{24}{9} = 2.66
\]
Spatial Covariance:
Consider the effect of adjacent cells
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.

\[ a^2 + b^2 = c^2 \quad \text{or} \quad c = \sqrt{(a^2 + b^2)} \]
Create a Cost Surface from R1C1
Use formula Distance x factor

Distance x 3

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<tr>
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cell size is 10

Formula
\[ \sqrt{(a^2 + b^2)} \times 3 \]

From Lecture Notes/Readings

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

Cost = Distance \times \text{fixed cost factor}

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.
Create a Cost Surface from R1C1
Use formula Distance × factor

### Distance × 3

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**Cell size is 10**

**Formula**
\[
\sqrt{(a^2 + b^2)} \times 3
\]

**From R1C1 to R2C2**
\[
\sqrt{10^2 + 10^2} \times 3
\]

14.1 × 3 = 42.4
Use a Friction Surface to create travel costs from R1C1

Use formula cell distance x friction
Use a Friction Surface to create travel costs from R1C1

Cell by cell distance * friction