x_i	y_i
2	3
1	-4
3	6
4	5
3	7

$n=5$

(1) $d_{SSD}:(x,y)\mapsto \|x-y\|_2^2 = \langle x-y, x-y\rangle = \sum_{i=1}^{5}(x_i-y_i)^2$

$= (2-3)^2+(1-(-4))^2+(3-6)^2+(4-5)^2+(3-7)^2$

$= (-1)^2+(5)^2+(-3)^2+(-1)^2+(-4)^2$

$= 1+25+9+1+16$

$= \mathbf{52}$

(2) $d_{MAE}:(x,y)\mapsto \frac{d_{SAD}}{n} = \frac{\|x-y\|_1}{n} = \frac{1}{n}\sum_{i=1}^{n}|x_i-y_i|$

$= \frac{1}{5}(|2-3|+|1-(-4)|+|3-6|+|4-5|+|3-7|)$

$= \frac{1}{5}(1+5+3+1+4)$

$= \frac{1}{5}(14)$

$= \frac{14}{5} = \mathbf{2.8}$

(3) $d_{MSE}:(x,y)\mapsto \frac{d_{SSD}}{n} = \frac{52}{5} = \mathbf{10.4}$

(4) $d_2:(x,y)\mapsto \|x-y\|_2 = \sqrt{d_{SSD}} = \sqrt{52} = 7.21$

(5) $d_1 \equiv d_{SAD}:(x,y)\mapsto \|x-y\|_1 = \sum_{i=1}^{5}|x_i-y_i|$

$= |2-3|+|1-(-4)|+|3-6|+|4-5|+|3-7|$

$= 1+5+3+1+4$

$= 14$

(6) $d_\infty:(x,y)\mapsto \|x-y\|_\infty = \lim_{p\to\infty}\left(\sum_{i=1}^{n}|x_i-y_i|^p\right)^{1/p} = \max_i |x_i-y_i|$

$= \max_i(1,5,3,1,4)$

$= 5$

$p=3$

(7) $d_p:(x,y)\mapsto \|x-y\|_p = \left(\sum_{i=1}^{n} |x_i-y_i|^3\right)^{1/p}$

$= \left(|2-3|^3+|1-(-4)|^3+|3-6|^3+|4-5|^3+|3-7|^3\right)^{1/3}$

$= \left(1^3+5^3+3^3+1^3+4^3\right)^{1/3}$

$= (1+125+27+1+64)^{1/3}$

$= (218)^{1/3}$

$= \mathbf{6.02}$

(8) $d_{CAD}:(x,y)\mapsto \sum_{i=1}^{n}\frac{|x_i-y_i|}{|x_i|+|y_i|} = \frac{|2-3|}{|2|+|3|}+\frac{|1-(-4)|}{|1|+|-4|}+\frac{|3-6|}{|3|+|6|}+\frac{|4-5|}{|4|+|5|}+\frac{|3-7|}{|3|+|7|}$

$= \frac{1}{5}+\frac{5}{5}+\frac{3}{9}+\frac{1}{9}+\frac{4}{10}$

$= \frac{6}{5}+\frac{4}{9}+\frac{2}{5}$

$= \frac{8}{5}+\frac{4}{9}$

$= \frac{92}{45}$

$= \mathbf{2.04}$

(9) $d_{cos}:(x,y)\mapsto 1-\frac{\langle x,y\rangle}{\|x\|_2\|y\|_2} = 1-\frac{\sum_{i=1}^{5} x_i y_i}{\sqrt{\sum_{i=1}^{5} x_i^2}\sqrt{\sum_{i=1}^{5} y_i^2}}$

$= 1-\frac{(2\cdot 3)+(1)(-4)+(3)(6)+(4)(5)+(3)(7)}{\sqrt{2^2+1^2+3^2+4^2+3^2}\sqrt{3^2+(-4)^2+6^2+5^2+7^2}}$

$= 1-\frac{61}{\sqrt{39}\sqrt{135}}$

$= 1-\frac{61}{\sqrt{5265}}$

$= 1-.841$

$= \mathbf{.159}$

(10) $d_{Pearson}:(x,y)\mapsto 1-Corr(x,y) = 1-.84 = \mathbf{.16}$

$Corr(x,y) = \frac{cov(x,y)}{\sigma_x\sigma_y} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i-\mu_x)(y_i-\mu_y)}{\sigma_x\ \sigma_y} = \frac{3.36}{(1.02)(3.93)} = .84$

$\mu_x = \frac{1}{5}(2+1+3+4+3) = \frac{13}{5} = 2.6$

$\mu_y = \frac{1}{5}(3+(-4)+6+5+7) = \frac{17}{5} = 3.4$

$\sigma_x = \sqrt{\frac{1}{5}\left((2-2.6)^2+(1-2.6)^2+(3-2.6)^2+(4-2.6)^2+(3-2.6)^2\right)} = \sqrt{\frac{1}{5}(5.2)} = 1.02$

$\sigma_y = \sqrt{\frac{1}{5}\left((3-3.4)^2+(-4-3.4)^2+(6-3.4)^2+(5-3.4)^2+(7-3.4)^2\right)} = \sqrt{\frac{1}{5}(77.2)} = 3.93$

$cov(x,y) = \frac{1}{5}\left[(2-2.6)(3-3.4)+(1-2.6)(-4-3.4)+(3-2.6)(6-3.4)+(4-2.6)(5-3.4)+(3-2.6)(7-3.4)\right]$

$= \frac{1}{5}\left[.24+11.84+1.04+2.24+1.44\right]$

$= \frac{1}{5}[16.8] = 3.36$