Chapter 3 - Data Set 1 — Walter Manger

Vector Operations

Vector Input

u =	0	0	1
v =	1	0	0

Perpendicular Test (Dot Product)

x on x	y on y	z on z
0	0	0

Result (Sum of dot product result)

0	Perpendicular

Angle between u and v

u · v	/ ||u||	* ||v|| =	Cos θ	
0	1	1	0	Rad
		θ =	90	Deg

Parallel Test (Using Scalar Multiple)

0		

Result (If parallel test produces all of the same number)

----> Not Parallel

Cross Product of u and v (Det of i j k matrix)

uXv =	0	1	0

i j k Matrix

i	j	k
0	0	1
1	0	0

Perpendicular Test (Cross of u and v should be Perpendicular to both u and v)

u1 on x	u2 on y	u3 on z	Result (Sum)	
0	0	0	0	----------> Perpendicular

v1 on x	v2 on y	v3 on z	Result (Sum)	
0	0	0	0	----------> Perpendicular

Area of the Parallelogram formed by u and v (Norm of uXv)

||uXv|| = 1

Plane Operations

Plane Input

P1 =	-1	0	2	5	
P2 =	1	0	0	7	

Corresponding Normal

	-1	0	2 = n1
	1	0	0

Cross Product of P1 and P2 = A vector parallel to both planes

P1XP2 =	0	-2.00	0

Create a third plane that is Perpendicular to P1 and P2 going through point p

	x0	yo	zo
p =	0	0	0

Equation for the Third plane Perpendicular to P1 and P2 (Using a(x-x0)+b(y-y0)+c(z-z0))

ax	by	cz	-ax0-by0-czo	
0x	-2y	0z	0	= 0

Line Parallel or Perpendicular to a P1?

Line: (a, b, c) + t(d, e, f)

1	2	3	4	1	2

Two Values for t

T1 =	0
T2 =	1

Point @ T1	1	2	3
Point @ T2	5	3	5
V1 (T2 - T1)			
	4	1	2

V1 is Parallel to P1? (Dot Prodcut of P1 > Normal & V1)

x on x	y on y	z on z	
-4	0	4	---------->

Result (Sum of dot product result)

0	Perpendicular

Angle between u and v

V1 · n1	/ ||V1||	* ||n1|| =	Cos θ	
0	4.582576	2.236068	0	Rad
		θ =	90	Deg

Parallel Test (Using Scalar Multiple)

-0.25	0	1

Result (If parallel test produces all of the same number)

----> Not Parallel

Chapter 4 - Standard Matrices

Reflection y

			Standard Vector		**Answer**
-1	0	*	1	x =	-1.00
0	1		0	y =	0.00

Reflection x

1	0	*	1	x =	1.00
0	-1		0	y =	0.00

Reflection x=y

0	1	*	1	x =	0.00
1	0		0	y =	1.00

Rotation θ = 90

0.00	-1.00	*	1	x =	0.00
1.00	0.00		0	y =	1.00

θ = 1.570796 rad

Orthogonal Projection x

			Standard Vector		**Answer**
1	0	*	1	x =	1.00
0	0		0	y =	0.00

Orthogonal Projection y

0	0	*	1	x =	0.00
0	1		0	y =	0.00

Contraction k = 1

1	0	*	1	x =	1.00
0	1		0	y =	0.00

Dilation k = 1

1	0	*	1	x =	1.00
0	1		0	y =	0.00

Chapter 3 - Data Set 2 — Walter Manger

Vector Operations

Vector Input

u =	1	0	0
v =	0	1	0

Perpendicular Test (Dot Product)

x on x	y on y	z on z
0	0	0

Result (Sum of dot product result)

0	Perpendicular

Angle between u and v

u · v	/ ||u||	* ||v|| =	Cos θ	
0	1	1	0	Rad
		θ =	90	Deg

Parallel Test (Using Scalar Multiple)

	0	

Result (If parallel test produces all of the same number)

----> Not Parallel

Cross Product of u and v (Det of i j k matrix)

uXv =	0	0	1

i j k Matrix

i	j	k
1	0	0
0	1	0

Perpendicular Test (Cross of u and v should be Perpendicular to both u and v)

u1 on x	u2 on y	u3 on z	Result (Sum)		
0	0	0	0	---------->	Perpendicular

v1 on x	v2 on y	v3 on z	Result (Sum)		
0	0	0	0	---------->	Perpendicular

Area of the Parallelogram formed by u and v (Norm of uXv)

||uXv|| =	1

Plane Operations

Plane Input

P1 =	2	0	6	-8	
P2 =	0	-5	0	3	

Corresponding Normal

2	0	6	= n1
0	-5	0	

Cross Product of P1 and P2 = A vector parallel to both planes

P1XP2 =	30	0.00	-10

Create a third plane that is Perpendicular to P1 and P2 going through point p

	x0	yo	zo
p =	1	2	3

Equation for the Third plane Perpendicular to P1 and P2 (Using a(x-x0)+b(y-y0)+c(z-z0))

ax	by	cz	-ax0-by0-czo	
30x	0y	-10z	-6	= 0

Line Parallel or Perpendicular to a P1?

Line: (a, b, c) + t(d, e, f)

	2	2	2	4	1	8

Two Values for t

T1 =	0
T2 =	1

Point @ T1	2	2	2
Point @ T2	6	3	10

V1 (T2 - T1)

	4	1	8

V1 is Parallel to P1? (Dot Prodcut of P1 > Normal & V1)

x on x	y on y	z on z		
8	0	48	---------->	56 Not Perpendicular

Result (Sum of dot product result)

Angle between u and v

V1 · n1	/ ||V1||	* ||n1|| =	Cos θ	
56	9	6.324555	0.98382	Rad
		θ =	10.32091	Deg

Parallel Test (Using Scalar Multiple)

0.5	0	0.75

Result (If parallel test produces all of the same number)

----> Not Parallel

Chapter 4 - Standard Matrices

Reflection y

			Standard Vector		**Answer**
-1	0	*	10	x =	-10.00
0	1		10	y =	10.00

Reflection x

1	0	*	10	x =	10.00
0	-1		10	y =	-10.00

Reflection x=y

0	1	*	10	x =	10.00
1	0		10	y =	10.00

Rotation θ = 90

0.00	-1.00	*	10	x =	-10.00
1.00	0.00		10	y =	10.00

θ = 1.570796 rad

Orthogonal Projection x

			Standard Vector		**Answer**
1	0	*	10	x =	10.00
0	0		10	y =	0.00

Orthogonal Projection y

0	0	*	10	x =	0.00
0	1		10	y =	10.00

Contraction k = 0.5

0.5	0	*	10	x =	5.00
0	0.5		10	y =	5.00

Dilation k = 4

4	0	*	10	x =	40.00
0	4		10	y =	40.00

Chapter 3 - Data Set 3 — Walter Manger

Vector Operations

Vector Input

u =	3	4	2
v =	5	2	9

Perpendicular Test (Dot Product)

x on x	y on y	z on z
15	8	18

Result (Sum of dot product result)

41	Not Perpendicular

Angle between u and v

u · v	/ ||u||	* ||v|| =	Cos θ	
41	5.385165	10.48809	0.72592	Rad
		θ =	43.4546	Deg

Parallel Test (Using Scalar Multiple)

0.6	2	0.222222

Result (If parallel test produces all of the same number)

----> Not Parallel

Cross Product of u and v (Det of i j k matrix)

uXv =	32	-17	-14

i j k Matrix

i	j	k
3	4	2
5	2	9

Perpendicular Test (Cross of u and v should be Perpendicular to both u and v)

u1 on x	u2 on y	u3 on z	Result (Sum)		
96	-68	-28	0	---------->	Perpendicular

v1 on x	v2 on y	v3 on z	Result (Sum)		
160	-34	-126	0	---------->	Perpendicular

Area of the Parallelogram formed by u and v (Norm of uXv)

||uXv|| = 38.84585

Plane Operations

Plane Input

P1 =	1	2	3	4	
P2 =	-4	7	-2	6	

Corresponding Normal

1	2	3	= n1
-4	7	-2	

Cross Product of P1 and P2 = A vector parallel to both planes

P1XP2 =	-25	10.00	15

Create a third plane that is Perpendicular to P1 and P2 going through point p

	x0	yo	zo
p =	5	2	7

Equation for the Third plane Perpendicular to P1 and P2 (Using a(x-x0)+b(y-y0)+c(z-z0))

ax	by	cz	-ax0-by0-czo	
-25x	10y	15z	-14	= 0

Line Parallel or Perpendicular to a P1?

Line: (a, b, c) + t(d, e, f)

0	4	8	1	1	1

Two Values for t

T1 =	0
T2 =	1

Point @ T1	0	4	8
Point @ T2	1	5	9

V1 (T2 - T1)

1	1	1

V1 is Parallel to P1? (Dot Prodcut of P1 > Normal & V1)

x on x	y on y	z on z		
1	2	3	---------->	6 Not Perpendicular

Result (Sum of dot product result)

Angle between u and v

V1 · n1	/ ||V1||	* ||n1|| =	Cos θ	
6	1.732051	3.741657	0.92582	Rad
		θ =	22.20765	Deg

Parallel Test (Using Scalar Multiple)

1	2	3

Result (If parallel test produces all of the same number)

----> Not Parallel

Chapter 4 - Standard Matrices

Reflection y

			Standard Vector		Answer
-1	0	*	-10	x =	10.00
0	1		0	y =	0.00

Reflection x

1	0	*	-10	x =	-10.00
0	-1		0	y =	0.00

Reflection x=y

0	1	*	-10	x =	0.00
1	0		0	y =	-10.00

Rotation θ = 90

0.00	-1.00	*	-10	x =	0.00
1.00	0.00		0	y =	-10.00

θ = 1.570796 rad

Orthogonal Projection x

			Standard Vector		Answer
1	0	*	-10	x =	-10.00
0	0		0	y =	0.00

Orthogonal Projection y

0	0	*	-10	x =	0.00
0	1		0	y =	0.00

Contraction k = 0.2

0.2	0	*	-10	x =	-2.00
0	0.2		0	y =	0.00

Dilation k = -6

-6	0	*	-10	x =	60.00
0	-6		0	y =	0.00