1 개요

1.1 기본 원리

JSON ⇒ Structure ⇒ Algorithm ⇒ Structure ⇒ JSON

1.2 설명

1.2.1 JSON

평면 정보

1.2.2 Structure

JSON + 도형간의 관계

1.2.3 Algorithm

도형 위치를 정하는 규칙

2 기본 사항

2.1 색인

	약어
	structure key
	약어 설명
	부분 결과

2.2 약어

2.2.1 Boolean

TR	true
FA	false

2.2.2 조건문

IF	if
EI	else if
EL	else

2.2.3 반복문

FE	for each
FO	for
BR	break

2.3 기호

2.3.1 ≡ **equal**

$A \equiv B$	A와 B가 같다

2.3.2 ≠ **not equal**

$A \neq B$	A와B가 다르다

2.3.3 = **assignment**

$A = B$	B를 A에 대입

2.3.4 ∥ parallel or tangent

$A \parallel B$			
	IF	A와 B가 선이나 선분	A와 B가 평행
	EL	A와 B가 접함	

2.3.5 And ∧

$\wedge$	a_1
	a_2
	$\cdots$
	a_n

$= a_1 \wedge a_2 \wedge \cdots \wedge a_n$

2.3.6 Or ∨

$\vee$	a_1
	a_2
	$\cdots$
	a_n

$= a_1 \vee a_2 \vee \cdots \vee a_n$

2.3.7 좌표

$[x, y]$

2.3.8 집합

집합을 배열 $[a, b, \ldots]$로 표현

2.3.9 함수 합성

$f_1 \circ f_2 \circ \cdots \circ f_n(\mathbf{x}) = f_1(f_2(\cdots(f_n(\mathbf{x}))\cdots)$

2.3.10 조건문

1. IF | A

   1 If $A \equiv$ TR, then

2. IF | A | B

   1 If $A \equiv$ TR, then B.

3. EI | A

   1 Else if $A \equiv$ TR, then

4. EI | A | B

   1 Else if $A \equiv$ TR, then B.

5. EL

   1 Else

6. EL | B

   1 Else B

2.3.11 반복문

1. FO | A

   1 For A

2. FO | A | B

   1 For A do B

3. FE | A

   1 For each A

4. FE | A | B

   1 For each A do B

2.3.12 Operator

1. $\boxed{A \mid \circ \mid B}$

   $\boxed{1}$ $A \circ B$

2.4 함수

2.4.1 $\mathrm{m}(r, s)$ **mod**

1. **정의**
   r을 s로 나누었을 때 나머지

2. **계산**
   $\mathrm{m}(r, s) = \left\lfloor \frac{r}{s} \right\rfloor$

2.4.2 $\mathrm{atan2}(y, x)$

1. **정의**
   점 $[x, y]$를 극좌표로 표현할 때의 각 $(-\pi \leq \mathrm{atan2}(y, x) \leq \pi)$

2. **계산**

IF	$\wedge$ $\begin{array}{\|c\|}\hline x > 0 \\ \hline y \neq 0 \\ \hline \end{array}$	$\mathrm{atan2}(y, x) = \arctan\left(\frac{y}{\sqrt{x^2+y^2}+x}\right)$
EI	$\wedge$ $\begin{array}{\|c\|}\hline x < 0 \\ \hline y \equiv 0 \\ \hline \end{array}$	$\mathrm{atan2}(y, x) = \pi$
EL	미정	

2.4.3 $\mathrm{a}(\theta)$ **angle**

1. **정의**
   각 θ를 극좌표 각으로 표현했을 때의 값

2. **계산**
   $\mathrm{a}(\theta) = \left\lfloor \frac{\theta}{2\pi} \right\rfloor$

2.4.4 $\mathrm{a}(y, x)$ **angle**

1. **정의**
   점 $[x, y]$를 극좌표로 나타낼 때의 각

2. **계산**
   $\mathrm{a}(y, x) = \mathrm{a} \circ \mathrm{atan2}(y, x)$

2.4.5 $\mathrm{int}(O)$ **interior**

1. **정의**
   도형 O의 내부

2.4.6 $\mathrm{a}(\mathbf{p}_1, \mathbf{p}_2)$ **angle**

1. **정의**
   점 $\mathbf{p} = [x, y] = \mathbf{p}_2 - \mathbf{p}_1$를 극좌표로 표현했을때의 각

2. **계산**
   $\mathrm{a}(\mathbf{p}_1, \mathbf{p}_2) = \mathrm{a}(y, x)$

2.4.7 $\mathrm{d}(\mathbf{p}_1, \mathbf{p}_2)$ **distance**

1. **정의**
   두 점 $\mathbf{p}_1 = [x_1, y_1]$, $\mathbf{p}_2 = [x_2, y_2]$의 거리

2. **계산**
   $\mathrm{d}(\mathbf{p}_1, \mathbf{p}_2) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

2.4.8 $\mathrm{c}(r, \theta)$ **Cartesian**

1. **정의**
   극좌표 $[r, \theta]$의 직교좌표 표현

2. **계산**
   $\mathrm{c}(r, \theta) = [r\cos\theta, r\sin\theta]$

2.4.9 $\mathrm{s}(r)$ **sign**

1. **정의**
   실수 r의 부호

2. **계산**

$$\mathrm{s}(r) = \begin{array}{|c|c|c|}\hline \text{IF} & r < 0 & -1 \\ \hline \text{EI} & r \equiv 0 & 0 \\ \hline \text{EL} & 1 & \\ \hline \end{array}$$

2.4.10 $\mathrm{k}(v, \mathcal{A})$ **key**

1. **정의**
   배열 $\mathcal{A}$에서 v의 key

2. **계산**
   $\mathcal{A}[\mathrm{k}(v, \mathcal{A})] = v$

2.4.11 $\mathrm{r}(\mathbf{p}, \mathbf{c}, \theta)$ **rotation**

1. **정의**
   점 $\mathbf{p} = [x, y]$를 $\mathbf{c} = [x_1, y_1]$를 중심으로 θ만큼 회전 이동한 점 계산

2. **계산**

$$\mathrm{r}(\mathbf{p}, \mathbf{c}, \theta) = (\mathbf{p} - \mathbf{c}) \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} + \mathbf{c}$$

2.4.12 $\mathrm{s}(\mathbf{p}_1, \mathbf{p}_2)$ **segment**

1. **정의**
   두 점 $\mathbf{p}_1$, $\mathbf{p}_2$를 끝점으로 가지는 선분

2. **계산**
   $\mathrm{s}(\mathbf{p}_1, \mathbf{p}_2) = [t\mathbf{p}_1 + (1-t)\mathbf{p}_2 \mid 0 \le t \le 1]$

2.4.13 $\mathrm{amm}(\mathcal{A})$ **angle mid max**

1. **정의**

   1 극좌표 각의 집합 $\mathcal{A}$을 크기순으로 나열 $\theta_0 \le \theta_1 \le \cdots \le \theta_n$

   2 연속항의 차이를 구함 $\delta_0 = \theta_0 - \theta_n, \delta_1 = \theta_1 - \theta_0, \ldots, \delta_n = \theta_n - \theta_{n-1}$

   3 $\delta_i = \max[\delta_0, \ldots, \delta_n]$를 만족하는 최소 i에 대해 $\mathrm{a}(\theta_i - \frac{\delta_i}{2})$를 계산

3 Structure

3.1 값

3.1.1 Boolean

TR
FA

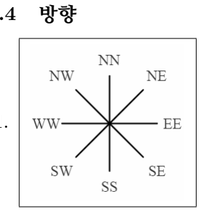
3.1.2 색

수	XX0	XX1	XX2	XX3	XX4	XX5
색	회색	청색	적색	청색	황색	녹색

3.1.3 좌표

[실수, 실수]

3.1.4 방향

1. 

2.

이름	EE	NE	NN	NW	WW	SW	SS	SE	CM
방향	동	북동	북	북서	서	남서	남	남동	중앙
각	0°	45°	90°	135°	180°	225°	270°	315°	

3.2 도형

1. **Structure**

key	값

2. **요소**

함수	structure key	정의	함수명 의미

3. **함수**

함수	정의	함수명 의미

3.2.1 Geometry2D: G

1. **Structure**

type	Geometry2D
object	도형 배열
window	$[[-x_{min}, x_{max}], [-y_{min}, y_{max}]]$
rotate	radian

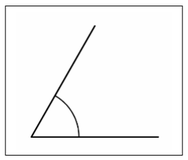
2. **요소**

o(G)	object	G위의 도형	object
s(G)	window	$[[x_{min}, x_{max}], [y_{min}, y_{max}]]$	size
a(G)	rotate	회전각	angle

3. **함수**

r(G)	$\frac{y_{max}-y_{min}}{x_{max}-x_{min}}$	ratio

3.2.2 Angle2D: A



1. **Structure**

type	AngleThreePt2D
height	실수
dash	boolean
color	색
visible	boolean
tickLabel	none, right, double, dot, circle, dash, dbldash, tpldash
selectable	boolean
selected	boolean
label	type: Static mode: math value: latex
labelSign	방향
id	자연수
vertexPoint	자연수
sourcePoint	자연수
targetPoint	자연수

2. **요소**

c(A)	vertex	중심	center
s(A)	source	시점	start
e(A)	target	종점	end
h(A)	height	c(A)에서 각표시까지의 거리	height
r(A)	right	직각 표시 여부	right

3. **함수**

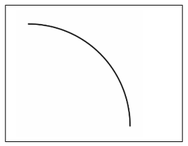
a(A)	중심각	angle

4. **관계**

$A_1 \cap A_2 \neq \emptyset \iff$

$\wedge$	c(A_1) $\equiv$ c(A_2)
	h(A_1) == h(A_2)

3.2.3 Arc2D: A



1. **Structure**

type	ArcFree2D
angle	radian
dash	boolean
color	color
visible	boolean
tickLabel	none, single, double, triple
selectable	boolean
selected	boolean
label	type: Static mode: math value:
labelSign	방향
measure	visible: boolean height: 실수 color: 색 label: type: Static, mode: math, value: labelSign: 방향 tickLabel: none, single, double, triple type: MeasureArcGeo2D center: 좌표 pointStart: 좌표 angle: radian
id	자연수
centerPoint	자연수
startPoint	자연수

2. **요소**

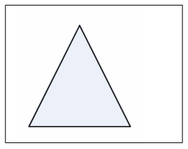
c(A)	center	중심	center
s(A)	pointStart	시점	start
a(A)	angle	중심각	angle
m(A)	measure	measure	measure
h $\circ$ m(A)	height	c(A)에서 $m(A)$ 중심까지의 거리	height
ld $\circ$ m(A)	labelSign	m(A)의 label 방향	label direction

3. **함수**

$e(A)$	종점	end
r(A)	d(c(A), s(A))	radius

4. **관계**

3.2.4 Face2D: F



1. **Structure**

type	FaceBoundaries2D
color	색
visible	boolean
selectable	boolean
selected	boolean
label	type: Static mode: math value:
labelSign	방향
id	자연수
boundaries	[자연수, 자연수, 자연수]

2. **요소**

e(F)	boundaries	변	edge

3. **함수**

c(F)	중	center
v(F)	꼭짓점	vertex

3.2.5 Label2D: L

1. **Structure**

type	LabelFree2D
coord	좌표
color	색
selectable	boolean
selected	boolean
label	type: Static mode: math value: latex
labelSign	방향
labeledObject	자연수
labelType	
labelUnit	
id	자연수

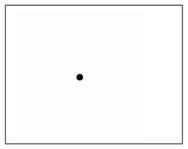
2. **요소**

c(L)	coord	중심	center
o(L)	labeledObject	label을 붙이는 도형	object
d(L)	labelSign	방향	direction

3. **함수**

s(L)	크기 $[x, y]$	size

3.2.6 Point2D: P



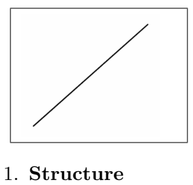
1. **Structure**

type	PointFree2D
coord	좌표
isFill	boolean
color	색
visible	boolean
selectable	boolean
selected	boolean
label	type: Static mode: math value:
labelSign	방향
id	자연수

2. **요소**

c(P)	coord	좌표	coordinates

3.2.7 Segment2D: S



1. **Structure**

type	LineSegFree2D
source	arrow: boolean
target	arrow: boolean
dash	boolean
color	색
visible	boolean
tickLabel	none, single, double, triple, quadruple, dot, circle
parallel	none, single, double, triple
selectable	boolean
selected	boolean
label	type: Static mode: math value:
labelSign	방향
measure	height: 실수 color: 색 label: type: Static, mode: math, value: labelSign: 방향 tickLabel: none, single, double type: MeasureGeo2D source: 좌표 target: 좌표
id	자연수
sourcePoint	자연수
targetPoint	자연수

2. **요소**

s(S)	source	시점	start
e(S)	target	종점	end
m(S)	measure	measure	measure

h ∘ m(S)	height	S 중심과 m(S) 중심 사이 거리	height
l ∘ m(S)	label	m(S)의 label	label
ld ∘ m(S)	labelSign	label 방향	label direction
l(S)	label	label	label
ld(S)	labelSign	label 뱡향	label direction

3. **함수**

v(S)	e(S) − s(S)	vector
a(S)	a(s(S), e(S))	angle
l(S)	l(s(S), e(S))	length
a ∘ m(S)	$[\theta_s, \theta_e]$, m(S)의 시점 각과 종점 각	angle
r ∘ m(S)	m(S)를 포함하는 Arc2D의 반지름	radius

4 Algorithm

4.1 도형의 분류

4.1.1 Angle2D: $\mathcal{AN}$

$\mathcal{AN}_c$	color가 있는 Angle2D	Angle2D color
$\mathcal{AN}_s$	selectable한 Angle2D	Angle2D selectable
$\mathcal{AN}_t$	tickLabel이 표시된 Angle2D	Angle2D tickLabel
$\mathcal{AN}_{\bar{t}}$	$\mathcal{AN} - \mathcal{AN}_t$	Angle2D tickLabel complement

4.1.2 Arc2D: $\mathcal{AR}$

$\mathcal{AR}_d$	dash인 Arc2D	Arc2D dash
$\mathcal{AR}_m$	measure가 있는 Arc2D	Arc2D measure

4.1.3 Face2D: $\mathcal{F}$

4.1.4 Label2D: $\mathcal{L}$

4.1.5 Point2D: $\mathcal{P}$

4.1.6 Segment2D: $\mathcal{S}$

$\mathcal{S}_d$	dash인 Segment2D	Segment2D dash
$\mathcal{S}_m$	measure가 있는 Segment2D	Segment2D measure
$\mathcal{S}_{ml}$	measure에 label이 있는 Segment2D	Segment2D measure label
$\mathcal{S}_p$	parallel이 표시된 Segment2D	Segment2D parallel
$\mathcal{S}_{li}$	line으로 표현된 Segment2D	Segment2D line

4.2 Segment2D parallel 표시 방향 통일

1	FE	$S \in \mathcal{S}_p$	IF	$\pi \leq \mathrm{a}(S) < 2\pi$	$\mathrm{s}(S) \Leftrightarrow \mathrm{e}(S)$

4.3 Segment2D parallel 표시 단순화

1	FE	$S_1 \in \mathcal{S}_p$	FE	$S_2 \in \mathcal{S}_p$	IF	$S_1 \subseteq S_2$	S_1 parallel 표시 제거
					EI	$S_2 \subsetneq S_1$	S_2 parallel 표시 제거

4.4 Angle2D의 height 결정

FE	$A \in \mathcal{AN}_t$	$\mathrm{h}(A) = \frac{1}{\mathrm{r}(G)}$						
$\mathcal{AN}_{\bar{t}}$가 다음을 만족하도록 정렬	$\mathrm{a}(\mathcal{AN}_{\bar{t}}[i]) \leq \mathrm{a}(\mathcal{AN}_{\bar{t}}[j]) \Leftrightarrow i \leq j$							
$h_i = 0.25$	height increment							
$h_{ir} = \frac{h_i}{\sqrt{2}}$	height increment right							
1	IF	$\wedge$ $\lvert\mathcal{AN}_s\rvert \neq 0$; $\lvert\mathcal{AN}_s\rvert + \lvert\mathcal{AN}_c\rvert \geq \lvert\mathcal{AN}\rvert$	FE	$A \in \mathcal{AN}_{tn}$	IF	$\mathrm{r}(A) \equiv$ TR	$\mathrm{h}(A) = 0.7$	
					EL	$\mathrm{h}(A) = \min(1, 0.7 + \max(0, 1 - \frac{\mathrm{a}(A)}{\frac{\pi}{2}}))$		
					$\mathrm{h}(A) = \frac{1}{\mathrm{r}(G)}$			
	EL	FO	i	FE	$A \in \mathcal{AN}_t$	IF	$\wedge$ A and $\mathcal{AN}_{tn}[i]$ overlap; $\mathrm{h}(A) \equiv \mathrm{h}(\mathcal{AN}_{tn}[i])$	IF $\mathrm{r}(\mathcal{AN}_{tn}[i]) \equiv$ TR: $\mathrm{h}(\mathcal{AN}_{tn}[i]) += h_{ir}$
								EL: $\mathrm{h}(\mathcal{AN}_{tn}[i]) += h_i$
				FO	$j < i$	IF	$\wedge$ $\mathcal{AN}_{tn}[j]$ and $\mathcal{AN}_{tn}[i]$ overlap; $\mathrm{h}(\mathcal{AN}_{tn}[j]) \equiv \mathrm{h}(\mathcal{AN}_{tn}[i])$	IF $\wedge$ $\mathrm{r}(\mathcal{AN}_{tn}[i]) \equiv$ TR, $\mathrm{r}(\mathcal{AN}_{tn}[i]) \equiv$ FA: $\mathrm{h}(\mathcal{AN}_{tn}[i]) += h_{ir}$
								EI $\mathrm{r}(\mathcal{AN}_{tn}[i]) \equiv$ FA: $\mathrm{h}(\mathcal{AN}_{tn}[i]) += h_i$
								$\mathrm{h}(\mathcal{AN}_{tn}[i]) = \frac{\mathrm{h}(\mathcal{AN}_{tn}[i])}{\mathrm{r}(G)}$

4.5 Arc2D의 measure height 결정

1	FE	$A \in \mathcal{AR}_m$	$\mathrm{h} \circ \mathrm{m}(A) = \min(0.2 \cdot \mathrm{r}(A), 2)$

4.6 Segment2D의 measure height 결정

4.6.1 height의 절대값 결정

1	FE	$S \in \mathcal{S}_m$	$r = \frac{\mathrm{l}(S)}{\sin\frac{\pi}{8}}$	radius
			$\mathrm{h} \circ \mathrm{m}(S) = r - \sqrt{r^2 - \left(\frac{r}{2}\right)^2}$	

4.6.2 S를 지나는 도형 O의 각 수집

$\mathcal{A}_s$	s(S)를 지나는 도형의 각
$\mathcal{A}_e$	e(S)를 지나는 도형의 각

$\theta_s = \mathrm{a}(-\mathrm{a}(S))$	angle start
$\theta_e = \mathrm{a}(S)$	angle end

IF $O \equiv S_1 \in \mathcal{S}$

IF $\wedge$ ($S \neq S_1$, $S \nparallel S_1$, $S \not\subseteq S_1$, $S_1 \not\subseteq S$)

$\theta_{1s} = \mathrm{a}(-\mathrm{a}(S_1))$	angle 1 start		
$\theta_{1e} = \mathrm{a}(S_1)$	angle 1 end		
IF	$\mathrm{s}(S) \in S_1$	**IF** $\mathrm{s}(S) \equiv \mathrm{s}(S_1)$	$\mathcal{A}_s[\,] = \theta_{1e}$
		EI $\mathrm{s}(S) \equiv \mathrm{e}(S_1)$	$\mathcal{A}_s[\,] = \theta_{1s}$
		EL	$\mathcal{A}_s[\,] = \theta_{1s}$; $\mathcal{A}_s[\,] = \theta_{1e}$
EI	$\mathrm{e}(S) \in S_1$	**IF** $\mathrm{e}(S) \equiv \mathrm{s}(S_1)$	$\mathcal{A}_s[\,] = \theta_{1e}$
		EI $\mathrm{e}(S) \equiv \mathrm{e}(S_1)$	$\mathcal{A}_s[\,] = \theta_{1s}$
		EL	$\mathcal{A}_s[\,] = \theta_{1s}$; $\mathcal{A}_s[\,] = \theta_{1e}$

1

IF $O \equiv A \in \mathcal{AR}$

IF $\mathrm{s}(S) \in A$

$\theta_{1s} = \mathrm{a}(\mathrm{c}(A), \mathrm{s}(S))$	angle 1 start		
IF	$\mathrm{s}(S) \equiv \mathrm{s}(A)$	$\mathcal{A}[\,] = \mathrm{a}(\theta_{1s} + \frac{\pi}{2})$	
EI	$\mathrm{s}(S) \equiv \mathrm{e}(A)$	$\mathcal{A}[\,] = \mathrm{a}(\theta_{1s} - \frac{\pi}{2})$	
EL		$\mathcal{A}[\,] = \mathrm{a}(\theta_{1s} + \frac{\pi}{2})$; $\mathcal{A}[\,] = \mathrm{a}(\theta_{1s} - \frac{\pi}{2})$	

IF $\mathrm{e}(S) \in A$

$\theta_{1e} = \mathrm{a}(\mathrm{c}(A), \mathrm{e}(S))$	angle 1 end		
IF	$\mathrm{e}(S) \equiv \mathrm{s}(A)$	$\mathcal{A}[\,] = \mathrm{a}(\theta_{1e} + \frac{\pi}{2})$	
EI	$\mathrm{e}(S) \equiv \mathrm{e}(A)$	$\mathcal{A}[\,] = \mathrm{a}(\theta_{1e} - \frac{\pi}{2})$	
EL		$\mathcal{A}[\,] = \mathrm{a}(\theta_{1e} + \frac{\pi}{2})$; $\mathcal{A}[\,] = \mathrm{a}(\theta_{1e} - \frac{\pi}{2})$	

IF $O \equiv A \in \mathcal{AN}$

$\theta_{1s} = \mathrm{a}(\mathrm{c}(A), \mathrm{s}(A))$	angle 1 start
$\theta_{1e} = \mathrm{a}(\mathrm{c}(A), \mathrm{e}(A))$	angle 1 end
$n_a = \left\lceil \frac{6\mathrm{a}(A)}{\pi} \right\rceil$	number angle

IF $\mathrm{s}(S) \equiv \mathrm{c}(A)$

IF	$\theta_s \equiv \theta_{1s}$	**FO**	$0 \le i \le n_a$	$\mathcal{A}_s[\,] = \mathrm{a}(\theta_{1s} + \frac{\mathrm{a}(A)}{n_a} i)$
EI	$\theta_s \equiv \theta_{1e}$	**FO**	$0 \le i \le n_a$	$\mathcal{A}_s[\,] = \mathrm{a}(\theta_{1e} - \frac{\mathrm{a}(A)}{n_a} i)$

IF $\mathrm{e}(S) \equiv \mathrm{c}(A)$

IF	$\theta_e \equiv \theta_{1s}$	**FO**	$0 \le i \le n_a$	$\mathcal{A}_e[\,] = \mathrm{a}(\theta_{1s} + \frac{\mathrm{a}(A)}{n_a} i)$
EI	$\theta_e \equiv \theta_{1e}$	**FO**	$0 \le i \le n_a$	$\mathcal{A}_e[\,] = \mathrm{a}(\theta_{1e} - \frac{\mathrm{a}(A)}{n_a} i)$

4.6.3 height 부호 결정

1

IF				
$\mathcal{A}_s \equiv [\,]$ $\mathcal{A}_e \equiv [\,]$	IF	$\vee$	$0 \le \theta_e \le \frac{\pi}{2}$ $\frac{3\pi}{2} < \theta_e < 2\pi$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
	EL			$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

2 EL

2 1

$\mathcal{A}_{sl} = [0, \theta \in \mathcal{A}_s \mid \mathrm{a}(\theta - \theta_s) < \pi]$	angle start left
$\mathcal{A}_{sr} = [0, \theta \in \mathcal{A}_s \mid \mathrm{a}(\theta_s - \theta) < \pi]$	angle start right
$\mathcal{A}_{el} = [0, \theta \in \mathcal{A}_e \mid \mathrm{a}(\theta - \theta_e) < \pi]$	angle end left
$\mathcal{A}_{er} = [0, \theta \in \mathcal{A}_e \mid \mathrm{a}(\theta_e - \theta) < \pi]$	angle end right
$\theta_{sl} = \max(\mathcal{A}_{sl})$	angle start left
$\theta_{sr} = \max(\mathcal{A}_{sr})$	angle start right
$\theta_{el} = \max(\mathcal{A}_{el})$	angle end left
$\theta_{er} = \max(\mathcal{A}_{er})$	angle end right
$\theta_l = \max(\theta_{sr}, \theta_{el})$	angle left
$\theta_r = \max(\theta_{sl}, \theta_{er})$	angle right

2 2

EL

IF	$\theta_l \ne \theta_r$	IF	$\theta_l < \theta_r$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
		EI	$\theta_l > \theta_r$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

IF	$\wedge$	$\theta_{sl} \equiv \theta_r$ $\theta_{sr} \equiv \theta_l$	IF	$\theta_{el} < \theta_{er}$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
		$\theta_{el} \ne \theta_l$ $\theta_{er} \ne \theta_r$	EI	$\theta_{el} > \theta_{er}$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
EI	$\wedge$	$\vee$ $\theta_{sl} \ne \theta_r$ $\theta_{sr} \ne \theta_l$	IF	$\theta_{sl} < \theta_{sr}$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
		$\theta_{el} \equiv \theta_l$ $\theta_{er} \equiv \theta_r$	EI	$\theta_{sl} > \theta_{sr}$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
EI	$\wedge$	$\theta_{sl} \equiv \theta_r$ $\theta_{sr} \ne \theta_l$	IF	$\theta_{sr} < \theta_{tr}$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
		$\theta_{el} \equiv \theta_l$ $\theta_{er} \ne \theta_r$	EI	$\theta_{sr} > \theta_{tr}$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
EI	$\wedge$	$\theta_{sl} \ne \theta_r$ $\theta_{sr} \equiv \theta_l$	IF	$\theta_{sl} < \theta_{tl}$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
		$\theta_{el} \ne \theta_l$ $\theta_{er} \equiv \theta_r$	EI	$\theta_{sl} > \theta_{tl}$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

2 3	IF	S가 두 평행선 사이의 거리를 나타냄	IF	$\wedge$: $\theta_{sl} \neq 0$; $\theta_{sr} \neq 0$; $\theta_{el} \neq 0$; $\theta_{er} \neq 0$; $\theta_{sl} \equiv \theta_{sr}$; $\theta_{el} \equiv \theta_{er}$; $\theta_{sl} + \theta_{sr} \equiv \pi$; $\theta_{el} + \theta_{er} \equiv \pi$	$v_{sl} \equiv$ FA	visible start left	
					$v_{sr} \equiv$ FA	visible start right	
					$v_{el} \equiv$ FA	visible end left	
					$v_{er} \equiv$ FA	visible end right	
					FE	$A \in \mathcal{AN}$	$\theta_{1s} = \mathrm{a}(\mathrm{c}(A), \mathrm{s}(A))$ angle 1 start; $\theta_{1e} = \mathrm{a}(\mathrm{c}(A), \mathrm{e}(A))$ angle 1 end
							IF $\mathrm{s}(S) \equiv \mathrm{c}(A)$: IF $\wedge$ [$\theta_e \equiv \theta_{1e}$; $\mathrm{a}(\theta_s + \theta_{sl}) \equiv \theta_{1s}$] $v_{sl} =$ TR; EI $\wedge$ [$\theta_e \equiv \theta_{1s}$; $\mathrm{a}(\theta_s - \theta_{sr}) \equiv \theta_{1e}$] $v_{sr} =$ TR
							EI $\mathrm{e}(S) \equiv \mathrm{c}(A)$: IF $\wedge$ [$\theta_s \equiv \theta_{1e}$; $\mathrm{a}(\theta_e + \theta_{el}) \equiv \theta_{1s}$] $v_{el} =$ TR; EI $\wedge$ [$\theta_s \equiv \theta_{1s}$; $\mathrm{a}(\theta_e - \theta_{er}) \equiv \theta_{1e}$] $v_{er} =$ TR
					IF	$\wedge$: ($v_{sl} \equiv$ TR $\vee$ $v_{er} \equiv$ TR); ($v_{sr} \equiv$ FA $\wedge$ $v_{el} \equiv$ FA)	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
					EI	$\wedge$: ($v_{sl} \equiv$ FA $\wedge$ $v_{er} \equiv$ FA); ($v_{sr} \equiv$ TR $\vee$ $v_{el} \equiv$ TR)	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
2 4	IF	S가 branch를 가짐		$n_l = 0$ 왼쪽 branch의 개수		number left	
				$n_r = 0$ 오른쪽 branch의 개수		number right	
					IF	S를 가로지르는 도형이 존재	$n_l+ = 1$; $n_r+ = 1$
					EI	$\wedge$: $S_1 \in \mathcal{S}$; $S \nparallel S_1$	IF $\mathrm{s}(S_1) \in \mathrm{int}(S)$: IF $0 < \mathrm{a}(\mathrm{a}(S) - \mathrm{a}(S_1)) < \pi$ $n_l+ = 1$; EI $\pi < \mathrm{a}(\mathrm{a}(S) - \mathrm{a}(S_1)) < 2\pi$ $n_r+ = 1$
							EI $\mathrm{e}(S_1) \in \mathrm{int}(S)$: IF $0 < \mathrm{a}(-\mathrm{a}(S) - \mathrm{a}(S_1)) < \pi$ $n_l+ = 1$; EI $\pi < \mathrm{a}(-\mathrm{a}(S) - \mathrm{a}(S_1)) < 2\pi$ $n_r+ = 1$
					IF	$\wedge$: $A \in \mathcal{AR}$; $\lvert A \cap S \rvert \equiv \{\mathbf{p}\}$; $\mathbf{p} \in \mathrm{int}(S)$	IF $S \parallel A$: IF $0 < \mathrm{a}(\mathrm{a}(\mathbf{p}, \mathrm{c}(A)) - \mathrm{a}(S)) < \pi$ $n_l+ = 1$; EI $\pi < \mathrm{a}(\mathrm{a}(\mathbf{p}, \mathrm{c}(A)) - \mathrm{a}(S)) < 2\pi$ $n_r+ = 1$
							IF $\mathrm{s}(S) = \mathbf{p}$ $n_l+ = 1$; $n_r+ = 1$
							EI $\mathrm{e}(S) = \mathbf{p}$ $n_l+ = 1$; $n_r+ = 1$
					IF	$\wedge$: $n_l \neq 0$; $n_r \equiv 0$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
					EI	$\wedge$: $n_l \equiv 0$; $n_r \neq 0$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

2 | 5	IF	$F \in \mathcal{F}$의 한변 S_1이 $S \subsetneq S_1$	$\theta_s = \mathrm{a}(\mathrm{c}(F), \mathrm{s}(S))$	angle start
			$\theta_e = \mathrm{a}(\mathrm{c}(F), \mathrm{e}(S))$	angle end
			IF $\mathrm{a}(\theta_e - \theta_s) < \pi$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
			EI $\mathrm{a}(\theta_e - \theta_s) > \pi$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

2 | 6	IF	∧	S가 부채꼴 S_1의 Arc2D A_1의 최장현(longest chord)				
			Angle2D A_2가 $A_2 \subset S_1$				
			$\mathrm{c}(A_1) \equiv \mathrm{c}(A_2)$				
				IF ∧ $\mathrm{s}(S) \equiv \mathrm{s}(A)$, $\mathrm{e}(S) \equiv \mathrm{e}(A)$	IF	$\mathrm{a}(A_1) < \frac{\pi}{2}$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
					EL		$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
				EI ∧ $\mathrm{s}(S) \equiv \mathrm{e}(A)$, $\mathrm{e}(S) \equiv \mathrm{s}(A)$	IF	$\mathrm{a}(A_1) < \frac{\pi}{2}$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
					EL		$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

3	IF	S의 양끝점이 두 평행선 $S_1, S_2 \in \mathcal{S}_{li}$ 위에 각각 위치	IF	$\mathrm{a}(S) < \pi$	$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
			EI	$\mathrm{a}(S) \geq \pi$	$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

4	IF	∧	$S \neq S_1$	$n_l = 0$	S의 왼쪽에 위치한 S_1의 개수	number left
			S위에 한 끝점이 위치한 $S_1 \in \mathcal{S}_m$들이 존재	$n_r = 0$	S의 오른쪽에 위치한 S_1의 개수	number right
				IF ∧ $S \cap S_1 \equiv \mathrm{s}(S_1)$, $\mathrm{s}(S_1) \in \mathrm{int}(S)$	IF	$0 < \mathrm{a}(\mathrm{a}(S_1) - \mathrm{a}(S)) < \pi$	$n_l += 1$
					EI	$\pi < \mathrm{a}(\mathrm{a}(S_1) - \mathrm{a}(S)) < 2\pi$	$n_r += 1$
				EI ∧ $S \cap S_1 \equiv \mathrm{e}(S_1)$, $\mathrm{e}(S_1) \in \mathrm{int}(S)$	IF	$0 < \mathrm{a}(-\mathrm{a}(S_1) - \mathrm{a}(S)) < \pi$	$n_l += 1$
					EI	$\pi < \mathrm{a}(-\mathrm{a}(S_1) - \mathrm{a}(S)) < 2\pi$	$n_r += 1$
				IF ∧ $n_l \neq 0$, $n_r \equiv 0$			$\mathrm{h} \circ \mathrm{m}(S) = -\lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$
				EI ∧ $n_l \equiv 0$, $n_r \neq 0$			$\mathrm{h} \circ \mathrm{m}(S) = \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$

4.7 방향 결정

4.7.1 방향 관련 함수

1. $\mathcal{D}$ | 뱡향 배열 | direction

1	key	0	1	2	3	4	5	6	7
	value	EE	NE	NN	NW	WW	SW	SS	SE

2. $\mathrm{d}(\theta)$ | 각 θ에 따른 뱡향 | direction

1	IF	∨	$2\pi - \frac{\pi}{8} \leq \mathrm{a}(\theta)$, $\mathrm{a}(\theta) < \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{EE}$
	EI		$\frac{\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{NE}$
	EI		$\frac{2\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{2\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{NN}$
	EI		$\frac{3\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{3\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{NW}$
	EI		$\frac{4\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{4\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{WW}$
	EI		$\frac{5\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{5\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{SW}$
	EI		$\frac{6\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{6\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{SS}$
	EI		$\frac{7\pi}{4} - \frac{\pi}{8} \leq \mathrm{a}(\theta) < \frac{7\pi}{4} + \frac{\pi}{8}$	$\mathrm{d}(\theta) = \mathrm{SE}$

3. $\mathrm{d}(d, n)$ | 방향 변환 | direction

1	d	뱡향
	n	정수
	$\mathrm{d}(d, n) = \mathcal{D}[\mathrm{k}(d, \mathrm{m}(\mathcal{D} + n, 8)]$	

4.7.2 Segment2D measure

1	FE	$S \in \mathcal{S}_{ml}$	IF	$\mathrm{h} \circ \mathrm{m}(S) > 0$	$\mathrm{ld} \circ \mathrm{m}(S) = \mathrm{d}(\mathrm{a}(S) + \frac{\pi}{2} + \mathrm{a}(G))$
			EL	$\mathrm{ld} \circ \mathrm{m}(S) = \mathrm{d}(\mathrm{a}(S) - \frac{\pi}{2} + \mathrm{a}(G))$	

4.7.3 Segment2D들이 포함 관계를 가지고 있을 때

1	FE	$S \in \mathcal{S}_{ml}$	FE	$\wedge$	$S_1 \in \mathcal{S}_{ml}$ $S \subsetneq S_1$	IF	$\wedge$	$\mathrm{a}(S) \equiv \mathrm{a}(S_1)$ $\mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S) \equiv \mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S_1)$	$l_s = \mathrm{d}(\mathrm{s}(S_1), \mathrm{s}(S))$	length start
									$l_e = \mathrm{d}(\mathrm{e}(S_1), \mathrm{e}(S))$	length end
									IF: $\wedge$ $l_s < \frac{\mathrm{l}(S_1)}{2}$, $l_e < \frac{\mathrm{l}(S_1)}{2}$	IF: $l_s < l_e$: $\mathrm{ld} \circ \mathrm{m}(S) = \mathrm{d}(\mathrm{d} \circ \mathrm{m}(S), \mathrm{s} \circ \mathrm{h}(\mathrm{m}(S))$
										EI: $l_s > l_e$: $\mathrm{ld} \circ \mathrm{m}(S) = \mathrm{d}(\mathrm{d} \circ \mathrm{m}(S), -\mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S))$
						EI	$\wedge$	$\mathrm{a}(S) \equiv \mathrm{a}(-\mathrm{a}(S_1))$ $\mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S) \neq \mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S_1)$	$l_s = \mathrm{d}(\mathrm{s}(S_1), \mathrm{e}(S))$	length start
									$l_e = \mathrm{d}(\mathrm{e}(S_1), \mathrm{s}(S))$	length end
									IF: $\wedge$ $l_s < \frac{\mathrm{l}(S_1)}{2}$, $l_e < \frac{\mathrm{l}(S_1)}{2}$	IF: $l_s < l_e$: $\mathrm{ld} \circ \mathrm{m}(S) = \mathrm{d}(\mathrm{d} \circ \mathrm{m}(S), -\mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S))$
										EI: $l_s > l_e$: $\mathrm{ld} \circ \mathrm{m}(S) = \mathrm{d}(\mathrm{d} \circ \mathrm{m}(S), \mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S))$

4.7.4 Segment2D

1	FE	$S \in \mathcal{S}_l$	IF	$S \in \mathcal{S}_m$	IF	$\mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S) > 0$	$\mathrm{ld}(S) = \mathrm{d}(\mathrm{a}(S) - \frac{\pi}{2} + \mathrm{a}(G))$
					EI	$\mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S) < 0$	$\mathrm{ld}(S) = \mathrm{d}(\mathrm{a}(S) + \frac{\pi}{2} + \mathrm{a}(G))$
			EL	$\mathrm{ld}(S) = \mathrm{d} \circ \mathrm{m}(\mathrm{a}(S) - \frac{\pi}{2} + \mathrm{a}(G), \pi)$			

4.7.5 Arc2D measure

1	FE	$A \in \mathcal{AR}_{ml}$	$\mathrm{d} \circ \mathrm{m}(A) = \mathrm{d}(\mathrm{a}(\mathrm{c}(A), \mathrm{s}(A)) + \mathrm{a}(A) + \mathrm{a}(G))$

4.8 Label2D L의 좌표 $\mathrm{c}(L)$ 결정

1	$\mathcal{L}_c$	$L \in \mathcal{L}$에서 $\mathrm{c}(L)$이 결정된 것들	Label2D center

4.8.1 IF $\mathrm{o}(L) \equiv A \in \mathcal{AR}$

1	$\mathrm{ld}(L) = \mathrm{CM}$	
	$r = \mathrm{d}(\mathrm{c}(A), \mathrm{s}(A)) + 1$	radius
	$\theta = \mathrm{a}(\mathrm{c}(A), \mathrm{s}(A)) + \frac{\mathrm{a}(A)}{2}$	angle
	$\mathrm{c}(L) = \mathrm{c}(A) + \mathrm{c}(r, \theta)$	

4.8.2 IF $\mathrm{o}(L) \equiv A \in \mathcal{AN}$

$\theta_s = \mathrm{a}(\mathrm{c}(A), \mathrm{s}(A))$	angle start
$\theta_e = \mathrm{a}(\mathrm{c}(A), \mathrm{e}(A))$	angle end
$\theta_m = \mathrm{a}(\frac{\theta_s + \theta_e}{2})$	angle mid
$\theta_{ro} = \mathrm{a}(\frac{\pi}{2} - \theta_m)$	angle rotation
$\theta_l = \min(\pi, \mathrm{a}(\theta_e + \theta_{ro}))$	angle left
$\theta_r = \pi - \theta_l$	angle right

FO		IF			
	$0 \leq i \leq 3$		$\mathrm{a}(\frac{\pi}{2} i + \theta_{ro}) < \frac{\pi}{2}$	$\theta_{lr} = \mathrm{a}(\frac{\pi}{2} i + \theta_{ro})$	angle Label2D right

$\theta_{ll} = \theta_{lr} + \frac{\pi}{2}$	angle Label2D left
$l_{ll} = \mathrm{s}(L)[\mathrm{m}(i+1, 2)]$	length Label2D left
$l_{lr} = \mathrm{s}(L)[\mathrm{m}(i, 2)]$	length Label2D right
$d_{min} = 0.35$	distance min
$d_{minc} = \mathrm{h}(A) + 0.25$	distance min center
$w_{ll} = l_{ll} \cos(\frac{\pi}{2} - \theta_{ll})$	width Label2D left
$w_{lr} = l_{lr} \cos \theta_{lr}$	width Label2D right
$h_{ll} = l_{ll} \sin(\frac{\pi}{2} - \theta_{ll})$	height Label2D left
$h_{lr} = l_{lr} \sin \theta_{lr}$	height Label2D right
$h_{lmin} = \min(h_{ll}, h_{lr})$	height Label2D min
$h_{lmax} = \max(h_{ll}, h_{lr})$	height Label2D max

1

x_{lmin}	x Label2D min
y_{lminf}	y Label2D min fit

2

IF	$\wedge$ $\theta_r \leq \theta_{lr}$; $\theta_{ll} \leq \theta_l$	IF	$\theta_{lr} \leq \frac{\pi}{4}$	$x_{lmin} = -\frac{l_{lr} \cos(\theta_{lr} + \frac{\pi}{4})}{\sqrt{2}}$
		EL		$x_{lmin} = \frac{l_{ll} \cos(\pi - \theta_{ll} + \frac{\pi}{4})}{\sqrt{2}}$
				$y_{lminf} = \lvert x_{lmin} \rvert \tan \theta_r + \frac{d_m}{\cos \theta_r}$
EI	$\wedge$ $\theta_r \leq \theta_{lr}$; $\theta_l < \theta_{ll}$			$w_r = \frac{h_{ll}}{\tan \theta_r}$ — width right
				$x_{lmin} = \frac{w_{ll} - w_r}{2}$
				$w_t = w_{ll} + w_r + \frac{2 d_{min}}{\sin \theta_r}$ — width top
				$y_{lminf} = \frac{w_t \tan(\pi - \theta_r)}{2} - h_{ll}$
EI	$\wedge$ $\theta_{lr} < \theta_r$; $\theta_{ll} \leq \theta_l$			$w_l = \frac{h_{lr}}{\tan(\pi - \theta_l)}$ — width left
				$x_{lmin} = \frac{w_l - w_{lr}}{2}$
				$w_t = w_l + w_{lr} + \frac{2 d_{min}}{\sin(\pi - \theta_l)}$ — width top
				$y_{lminf} = \frac{w_t \tan(\theta_r)}{2} - h_{lr}$
EI	$\wedge$ $\theta_{lr} < \theta_r$; $\theta_l < \theta_{ll}$			$x_{lmin} = \frac{w_{ll} - w_{lr} + h_{lr} - h_{ll}}{2 \tan \theta_r}$
				$w_t = w_{ll} + w_{lr} + \frac{\lvert w_{ll} - h_{lr} \rvert}{\tan \theta_r} + \frac{2 d_{min}}{\sin \theta_r}$ — width top
				$y_{lminf} = \frac{w_t \tan \theta_r}{2} - h_{lmax}$

y_{lminc}	y Label2D min contact
y_{lmin}	y Label2D min
$x_{cl} = d_{minc} \cos(\theta_{ll} - \frac{\pi}{2})$	x contact left
$y_{cl} = \sqrt{d_{minc}^2 - x_{cl}^2}$	y contacnt left
$x_{cr} = d_{minc} \cos(\theta_{lr} + \frac{\pi}{2})$	x contact right
$y_{cr} = \sqrt{d_{minc}^2 - x_{cr}^2}$	y contact right

3

IF	$x_{lmin} \leq x_{cr}$	$y_{lminc} = y_{cr} - \lvert x_{cr} - x_{lmin} \rvert \tan \theta_{lr}$
EI	$x_{cr} < x_{lmin} < x_{cl}$	$y_{lminc} = \sqrt{d_{minc}^2 - x_{lmin}^2}$
EL	$y_{lminc} = y_{cl} - \lvert x_{cl} - x_{lmin} \rvert \tan(\pi - \theta_{ll})$	

$y_{lmin} = \min(y_{lminf}, y_{lminc})$

$l_{dh} = \frac{\sqrt{l_{ll}^2 + l_{lr}^2}}{2}$	length diagonal half
$\theta_d = \mathrm{a}(l_{ll}, l_{lr})$	angle diagonal
$\mathbf{c}_t = [x_{lmin}, y_{lmin}] + [l_{dh} \cos(\theta_{lr} + \theta_d), l_{dh} \sin(\theta_{lr} + \theta_d)]$	center translated
$\mathbf{c}_r = \mathrm{r}(\mathbf{c}_t, \mathbf{0}, -\theta_{ro})$	center rotated

4

$\mathrm{c}(L) = \mathbf{c}_r + \mathrm{c}(A)$

4.8.3 IF $\mathrm{o}(L) \equiv S \in \mathcal{S}$

$\mathrm{d}(L) = \mathrm{CM}$

$\theta_0 = \mathrm{a}(1, 0.5)$	angle 0
$\theta_1 = \mathrm{a}(1.5, 0.5)$	angle 1
$t_b = \mathrm{r}(G)$	thickness boundary

1

$\mathbf{b}$	boundary
θ_l	angle line

2

IF	$\vee$ $0 \leq \mathrm{a}(S) \leq \frac{3\pi}{4}$; $\frac{7\pi}{4} < \mathrm{a}(S) < \pi$	$\mathbf{b} = \mathrm{e}(S)$; $\theta_l = \mathrm{a}(S)$
EL	$\mathbf{b} = \mathrm{s}(S)$; $\theta_l = \mathrm{a}(\mathrm{a}(S) + \pi)$	

l_b	length boundary
$\mathbf{t}_b$	translation boundary

$\theta_t = \mathrm{a}(\theta_l + \pi)$

$\mathbf{t}_b = [0, 0]$

3

IF	$\vee$ $0 \leq \mathrm{a}(S) \leq \frac{3\pi}{4}$; $\frac{7\pi}{4} < \mathrm{a}(S) < \pi$	$l_b = \frac{t_b}{\lvert \cos \theta_l \rvert}$; IF $\mathrm{w}(G)[0][1] - \mathbf{b}[0] < l_b$: $\mathbf{t}_b = \mathrm{c}(l_b, \theta_t)$
EL	$l_b = \frac{t_b}{\lvert \sin \theta_l \rvert}$; IF $\lvert \mathrm{w}(G)[1][1] - \mathbf{b}[1] \rvert < l_b$: $\mathbf{t}_b = \mathrm{c}(l_b, \theta_t)$	

r	radius
θ	angle

$\mathrm{c}(L) = \mathrm{c}(r, \theta)$

4

IF — $\theta_l \equiv 0$

$r = \sqrt{1 + 0.5^2}$

IF	$1.5 \leq \mathrm{w}(G)[1][1] - \mathbf{b}[1]$	$\theta = \mathrm{a}(\pi - \theta_0)$
EL	$\theta = \mathrm{a}(\pi + \theta_0)$	

EI — $\theta_l \equiv \frac{\pi}{2}$

$r = \sqrt{1 + 0.5^2}$

IF	$1.5 \leq \mathrm{w}(G)[0][1] - \mathbf{b}[0]$	$\theta = \frac{3\pi}{2} + \theta_0$
EL	$\theta = \frac{3\pi}{2} - \theta_0$	

EI — $0 < \theta_l < \frac{\pi}{2}$ $\vee$ $\frac{7\pi}{4} < \theta_l \theta_l < 2\pi$

IF — $\mathbf{b}[1] < \mathrm{w}(G)[1][1]$

IF	$1.5 \leq \frac{\mathrm{w}(G)[1][1] - \mathbf{b}[1]}{\cos \theta_l}$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi - \theta_0)$
EI	$\theta_1 \leq \frac{\pi}{2} - \theta_l$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi + \theta_0)$
EL	$b = \frac{1.5 \cos \theta_l - (\mathrm{w}(G)[1][1] - \mathbf{b}[1])}{\sin \theta_l}$ (base) $r = \sqrt{1 + b^2}$ $\theta = \pi + \theta_l - \mathrm{a}(1, b)$	

EI — $\mathbf{b}[1] \equiv \mathrm{w}(G)[1][1]$

IF	$\theta_1 \leq \theta_l$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi - \theta_0)$
EI	$1.5 \leq \frac{\mathrm{w}(G)[1][1] - \mathbf{b}[1]}{\cos(\frac{\pi}{2} - \theta_l)}$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi + \theta_0)$
EL	$b = \frac{1.5}{\tan \theta_l}$ (base) $r = \sqrt{1 + b^2}$ $\theta = \pi + \theta_l - \mathrm{a}(1, b)$	

EI — $\frac{\pi}{2} < \theta_l < \frac{3\pi}{4}$

IF — $\mathbf{b}[1] < \mathrm{w}(G)[1][1]$

IF	$1.5 \leq \frac{\mathrm{w}(G)[1][1] - \mathbf{b}[1]}{\lvert \cos \theta_l \rvert}$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi + \theta_0)$
EI	$\theta_1 \leq \theta_l - \frac{\pi}{2}$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi - \theta_0)$
EL	$b = \frac{1.5 \lvert \cos \theta_l \rvert - (\mathrm{w}(G)[1][1] - \mathbf{b}[1])}{\sin \theta_l}$ (base) $r = \sqrt{1 + b^2}$ $\theta = \mathrm{a}(\theta_l + \pi + \mathrm{a}(1, b))$	

EI — $\mathbf{b}[1] \equiv \mathrm{w}(G)[1][1]$

IF	$\theta_1 \leq \theta_l - \frac{\pi}{2}$	$r = \sqrt{1 + 0.5^2}$ $\theta = \mathrm{a}(\theta_l + \pi - \theta +_0)$
EL	$b = \frac{1.5}{\lvert \tan \theta_l \rvert}$ (base) $r = \sqrt{1 + b^2}$ $\theta = \mathrm{a}(\theta_l + \pi + \mathrm{a}(1, b)$	

$\mathrm{c}(L) = \mathbf{b} + \mathbf{t}_b + \mathrm{c}(r, \theta)$

4.8.4 **IF** $\mathrm{o}(L) \equiv P \in \mathcal{P}$

	$\mathrm{d}(L) = \mathrm{CM}$		
1	$r = 1$		radius
	$\theta = \frac{\pi}{2}$		angle
	$\mathcal{A}_s$	Segement2D 관련 각들	angle segment

2	FE	$S \in \mathcal{S}$
		$P \in S$

	n_d	겹치지않는 P를 지나는 Segment2D의 개수	number direction
	$\theta_s = \mathrm{a}(-\mathrm{a}(S))$		angle start
2 1	$\theta_e = \mathrm{a}(S)$		angle end
	$\theta_{ms} = \mathrm{a} \circ \mathrm{m}(S)[0]$		angle measure start
	$\theta_{me} = \mathrm{a} \circ \mathrm{m}(S)[1]$		angle measure end

IF	$\mathrm{c}(P) \equiv \mathrm{s}(S)$	$\mathcal{A}_s[\,] = \theta_e$ IF $S \in \mathcal{S}_m$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + \theta_{ms})$
EI	$\mathrm{c}(P) \equiv \mathrm{e}(S)$	$\mathcal{A}_s[\,] = \theta_s$ IF $S \in \mathcal{S}_m$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_s + \theta_{me})$
EI	$\mathrm{c}(P) \in \mathrm{int}(S)$	$\mathcal{A}_s[\,] = \theta_s$ $\mathcal{A}_s[\,] = \theta_e$ d : P에서 $\mathrm{m}(S)$까지의 거리 — distance

IF $n_d \equiv 1$

$n_a = \left\lceil \frac{\pi}{\frac{5\pi}{180}} \right\rceil$ — number angle

- IF $\mathrm{h}(\mathrm{m}(S)) > 0$: FO $0 \le i \le n_a$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + \frac{\pi}{n_a} i)$
- EI $\mathrm{h}(\mathrm{m}(S)) < 0$: FO $0 \le i \le n_a$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_s + \frac{\pi}{n_a} i)$

EI $n_d \ge 2$

$l_s = \mathrm{d}(\mathrm{c}(P), \mathrm{s}(S))$	length start
$l_e = \mathrm{d}(\mathrm{c}(P), \mathrm{e}(S))$	length end
$s_m = \mathrm{s} \circ \mathrm{h} \circ \mathrm{m}(S)$	sign measure
$l_1 = \frac{\lvert l_s - l_e \rvert}{2}$	length 1
$l_2 = \mathrm{r} \circ \mathrm{m}(S) - \lvert \mathrm{h} \circ \mathrm{m}(S) \rvert$	length 2
$l_3 = \sqrt{l_1^2 + l_2^2}$	length 3
$l_4 = \mathrm{r} \circ \mathrm{m}(S) - 0.3$	length 4
$l_5 = \sqrt{l_4^2 - (l_2 + 0.3)^2}$	length 5
$l_6 = \sqrt{l_4^2 - l_2^2}$	length 6
$l_{min} = l_6 - l_2$	length min
$l_{max} = \sqrt{(l_1 + l_5)^2 + 0.3^2}$	length max
$\theta_1 = \mathrm{a}(l_2, l_1)$	angle 1
$\theta_2 = \mathrm{a} \circ \arccos(\frac{l_2^2 + 1 - l_4^2}{2 l_2})$	angle 2
$\theta_3 = \mathrm{a} \circ \arcsin(\frac{0.3}{l_4})$	angle 3
$\theta_4 = \mathrm{a}(\pi - (\theta_2 - \theta_1) + \theta_3)$	angle 4
$n_{a1} = \left\lceil \frac{\frac{\pi}{4}}{\frac{5\pi}{180}} \right\rceil$	number angle 1
$n_{a2} = \left\lceil \frac{l_4}{\frac{5\pi}{180}} \right\rceil$	number angle 2
$n_{a3} = \left\lceil \frac{\pi}{\frac{5\pi}{180}} \right\rceil$	number angle 3

IF ∧ ($S \in \mathcal{S}_m$, $d < 1.5$)

- IF $l_s \equiv l_e$
  - IF $1 \le l_{min}$: FO $0 \le i \le n_{a1}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e \pm s_m \frac{\frac{\pi}{4}}{n_{a1}} i)$
  - EI $l_{min} < 1 \le l_{max}$: FO $0 \le i \le n_{a2}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + s_m \frac{l_4}{n_{a2}})$
  - EL : FO $0 \le i \le n_{a3}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + s_m \frac{\pi}{n_{a3}} i)$
- EI $l_s > l_e$
  - IF $1 \le l_{min}$: FO $0 \le i \le n_{a1}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e \pm s_m \frac{\frac{\pi}{4}}{n_{a1}} i)$
  - EI $l_{min} < 1 \le l_{max}$: FO $0 \le i \le n_{a2}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + s_m \frac{l_4}{n_{a2}})$
  - EL : FO $(0 \le i \le n_{a3})$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + s_m \frac{\pi}{n_{a3}} i)$
- EL
  - IF $1 \le l_{min}$: FO $0 \le i \le n_{a1}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e \pm s_m \frac{\frac{\pi}{4}}{n_{a1}} i)$
  - EI $l_{min} < 1 \le l_{max}$: FO $0 \le i \le n_{a2}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_s - s_m \frac{l_4}{n_{a2}})$
  - EL : FO $0 \le i \le n_{a3}$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_e + s_m \frac{\pi}{n_{a3}} i)$

3

$\mathcal{A}_f$	angle Face2D	Face2D 관련 각 배열

FE	$F \in \mathcal{F}$	IF	$\wedge$	$\mathrm{c}(P) \in \mathrm{v}(F)$ $\mathrm{d}(\mathrm{c}(P), \mathrm{c} \circ \mathrm{o}(F)) \leq 3$	$\mathcal{A}_f[\,] = \mathrm{a}(\mathrm{c}(P), \mathrm{c} \circ \mathrm{o}(F))$

4

$\mathcal{A}_{arl}$	angle Arc2D left
$\mathcal{A}_{arr}$	angle Arc2D right
$\mathcal{A}_{arml}$	angle Arc2D measure left
$\mathcal{A}_{armr}$	angle Arc2D measure right

Arc2D 관련 각 배열

FE $A \in \mathcal{AR}$ — IF $P \in A$

$\theta_p = \mathrm{a}(\mathrm{c}(P), \mathrm{c}(A))$	angle point
$n_a = \left\lceil \frac{\frac{\pi}{2}}{\frac{5\pi}{180}} \right\rceil$	number angle

IF $P \in \mathrm{int}(A)$

- $\mathcal{A}_{arl}[\,] = \mathrm{a}(\theta_p + \frac{\pi}{2})$
- $\mathcal{A}_{arr}[\,] = \mathrm{a}(\theta_p - \frac{\pi}{2})$
- IF $A \in \mathcal{A}_{arml}$
  - FO $0 \leq i \leq n_a$: $\mathcal{A}_{arml}[\,] = \mathrm{a}(\theta_p + \pi + \frac{\frac{\pi}{2}}{n_a} i)$
  - FO $0 \leq i \leq n_a$: $\mathcal{A}_{armr}[\,] = \mathrm{a}(\theta_p + \pi - \frac{\frac{\pi}{2}}{n_a} i)$

EI $\mathrm{c}(P) \equiv \mathrm{s}(A)$

- $\mathcal{A}_{arr}[\,] = \mathrm{a}(\theta_p - \frac{\pi}{2})$
- IF $A \in \mathcal{A}_{arml}$
  - FO $0 \leq i \leq n_a$: $\mathcal{A}_{arml}[\,] = \mathrm{a}(\theta_p + \pi + \frac{\frac{\pi}{2}}{n_a} i)$

EL

- $\mathcal{A}_{arl}[\,] = \mathrm{a}(\theta_p + \frac{\pi}{2})$
- IF $A \in \mathcal{A}_{arml}$
  - FO $0 \leq i \leq n_a$: $\mathcal{A}_{armr}[\,] = \mathrm{a}(\theta_p - \pi - \frac{\frac{\pi}{2}}{n_a} i)$

$\mathcal{A}_{an}$	angle Angle2D	Angle2D와 관련된 각의 배열
$\mathcal{A}_{ansi}$	angle Angle2D start in	
$\mathcal{A}_{anso}$	angle Angle2D start out	
$\mathcal{A}_{anei}$	angle Angle2D end in	
$\mathcal{A}_{aneo}$	angle Angle2D end out	

5

FE $A \in \mathcal{AN}$

IF $\wedge$ [P가 A의 변에 포함 ; $\mathrm{c}(P) \neq \mathrm{c}(A)$; $\mathrm{d}(\mathrm{c}(P), \mathrm{c}(A)) - \mathrm{h}(A) \leq 1.5$]

$\theta_s = \mathrm{a}(\mathrm{s}(A), \mathrm{c}(A))$	angle start
$\theta_e = \mathrm{a}(\mathrm{e}(A), \mathrm{c}(A))$	angle end
$\theta_p = \mathrm{a}(\mathrm{c}(P), \mathrm{c}(A))$	angle Point2D

IF $\theta_p \equiv \theta_s$

$d_s = \mathrm{d}(\mathrm{c}(P), \mathrm{s}(A))$	distance start
$d_e = \sqrt{d_s^2 + \mathrm{h}(A)^2 - 2d_s \cdot \mathrm{h}(A) \cdot \cos \circ \mathrm{a}(A)}$	distance end
$\theta_v = \mathrm{a} \circ \arcsin(\frac{\mathrm{h}(A) \cdot \sin \circ \mathrm{a}(A)}{d_e})$	angle visible
$n_v = \left\lceil \frac{\theta_v}{\frac{5\pi}{180}} \right\rceil$	number visible

FO $0 \leq i \leq n_v$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_p - \frac{\theta_v}{n_v} i)$

EI $\theta_p \equiv \theta_e$

$d_e = \mathrm{d}(\mathrm{c}(A), \mathrm{e}(A))$	distance end
$d_s = \sqrt{d_p^2 + \mathrm{h}(A)^2 - 2d_e \cdot \mathrm{h}(A) \cdot \cos \circ \mathrm{a}(\theta)}$	distance start
$\theta_v = \arcsin(\frac{\mathrm{h}(A) \cdot \sin \circ \mathrm{a}(A)}{d_s})$	angle visible
$n_v = \left\lceil \frac{\theta_v}{\frac{5\pi}{180}} \right\rceil$	number visible

FO $0 \leq i \leq n_v$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_p + \frac{\theta_v}{n_v} i)$

IF $P \in A$

IF $\mathrm{c}(P) \equiv \mathrm{c}(A)$

$\theta_s = \mathrm{a}(\mathrm{c}(A), \mathrm{s}(A))$	angle start
$n_a = \left\lceil \frac{6\mathrm{a}(A)}{\pi} \right\rceil$	number angle

FO $0 \leq i \leq n_a$: $\mathcal{A}_{an}[\,] = \mathrm{a}(\theta_s + \frac{\mathrm{a}(A)}{n_a} i)$

EL

$\theta_p = \mathrm{a}(\mathrm{c}(P), \mathrm{c}(A))$	angle Point2D

IF $\mathrm{c}(P) \in \mathrm{int} \circ \mathrm{s}(\mathrm{c}(A), \mathrm{s}(A))$: $\mathcal{A}_{ansi}[\,] = \theta_p$; $\mathcal{A}_{anso}[\,] = \mathrm{a}(-\theta_p)$

EI $\mathrm{c}(P) \in \mathrm{int} \circ \mathrm{s}(\mathrm{c}(A), \mathrm{e}(A))$: $\mathcal{A}_{ansi}[\,] = \theta_p$; $\mathcal{A}_{anso}[\,] = \mathrm{a}(-\theta_p)$

IF $\wedge$ [$L \cap A \neq [\,]$; $\mathrm{c}(P) \equiv \mathrm{s}(A)$; $\mathrm{d}(\mathrm{c}(P), \mathrm{c}(A)) < \mathrm{h}(A) + 1.3$]

$\theta_1 = \mathrm{a}(\mathrm{c}(P), \mathrm{c}(A))$	angle 1
$\theta_2 = \mathrm{a}(1, \mathrm{d}(\mathrm{c}(P), \mathrm{c}(A)) - \mathrm{h}(A))$	angle 2
$n_a = \left\lceil \frac{\theta_2}{\frac{5\pi}{180}} \right\rceil$	number angle

FO $0 \leq i \leq n_a$: $\mathcal{A}_s[\,] = \mathrm{a}(\theta_1 + \frac{\theta_2}{n_a} i)$

IF	P가 Angle2D들에 싸이지않음	$\mathcal{A}_p = \mathcal{A}_s \cup \mathcal{A}_f \cup \mathcal{A}_{arr} \cup \mathcal{A}_{arl} \cup \mathcal{A}_{arml} \cup \mathcal{A}_{armr} \cup \mathcal{A}_{an}$
EL	$\mathcal{A}_p = \mathcal{A}_s \cup \mathcal{A}_f \cup \mathcal{A}_{arr} \cup \mathcal{A}_{arl} \cup \mathcal{A}_{arml} \cup \mathcal{A}_{armr}$	

$i_s =$ FA | P가 Segment2D위에만 위치하는지 여부 | is Segment2D

IF | $|\mathcal{A}_p| \neq 0$

IF	$\wedge$ $\|\mathcal{A}_{arl} \cup \mathcal{A}_{arr}\| \equiv 0$; $\|\mathcal{A}_{an}\| \equiv 0$; $\|\mathcal{A}_s\| \equiv 2$	$i_s =$ TR	
		IF	$\wedge$ $\|\mathcal{A}_{ansi} \cup \mathcal{A}_{anso}\| \equiv 2$; $\|\mathcal{A}_{anei} \cup \mathcal{A}_{aneo}\| \equiv 0$ → $\theta = \mathrm{a}(\mathcal{A}_{anso}[0] - \frac{\pi}{2})$
		EI	$\wedge$ $\|\mathcal{A}_{ansi} \cup \mathcal{A}_{anso}\| \equiv 04$; $\|\mathcal{A}_{anei} \cup \mathcal{A}_{aneo}\| \equiv 2$ → $\theta = \mathrm{a}(\mathcal{A}_{aneo}[0] + \frac{\pi}{2})$
		EL	$\theta = \mathrm{amm}(\mathcal{A}_p)$
EI	$\wedge$ $\|\mathcal{A}_{arl}\| \equiv 1$; $\|\mathcal{A}_{arr}\| \equiv 1$; $\|\mathcal{A}_{an}\| \equiv 0$; $\mathcal{A}_{arl}[0] \equiv \mathcal{A}_{arr}[0]$	IF	$\wedge$ $\|\mathcal{A}_{arml}\| \equiv 0$; $\|\mathcal{A}_{armr}\| \neq 0$ → $\theta = \mathrm{a}(\mathcal{A}_{armr}[0] + \frac{\pi}{4})$
		EI	$\wedge$ $\|\mathcal{A}_{arml}\| \neq 0$; $\|\mathcal{A}_{armr}\| \equiv 0$ → $\theta = \mathrm{a}(\mathcal{A}_{arml}[0] + \frac{\pi}{4})$
		EI	$\wedge$ $\|\mathcal{A}_{arml}\| \equiv 0$; $\|\mathcal{A}_{armr}\| \equiv 0$; $\|\mathcal{A}_s\| \equiv 0$ → $\theta = \mathrm{a}(\mathcal{A}_{arl}[0] + \frac{\pi}{2})$
		EL	$\theta = \mathrm{amm}(\mathcal{A}_p)$
EL	$\theta = \mathrm{amm}(\mathcal{A}_p)$		

IF | P가 Angle2D들에 둘러싸임 | $r = 0.5$

$\mathrm{c}(L) = \mathrm{c}(P) + \mathrm{c}(\mathrm{r}(G)r, \theta)$

IF | $i_s \equiv$ TR

$i_{ol} =$ FA | Label2D와 겹침 여부 | is overlap Label2D

FE | $L_1 \in \mathcal{L}_c$ | IF | $\wedge$ $|\mathrm{c}(L)[0] - \mathrm{c}(L_1)[0]| < \frac{\mathrm{s}(L)[0] + \mathrm{s}(L_1)[0]}{2}$; $|\mathrm{c}(L)[1] - \mathrm{c}(L_1)[1]| < \frac{\mathrm{s}(L)[1] + \mathrm{s}(L_1)[1]}{2}$ → $i_{ol} =$ TR

$i_{os} =$ FA | Segment2D와 겹침 여부 | is overlap Segment2D

$\mathbf{p}_{lmin} = \mathrm{c}(L) - [\frac{\mathrm{s}(L)[0]}{2}, \frac{\mathrm{s}(L)[1]}{2}]$

$\mathbf{p}_{lmax} = \mathrm{c}(L) + [\frac{\mathrm{s}(L)[0]}{2}, \frac{\mathrm{s}(L)[1]}{2}]$

FE | $S \in \mathcal{S}$; $P \notin S$

$\mathbf{p}_{smin} = [\min(\mathrm{s}(S)[0], \mathrm{e}(S)[0]), \min(\mathrm{s}(S)[1], \mathrm{e}(S)[1])]$ | point Segment2D min

$\mathbf{p}_{smax} = [\max(\mathrm{s}(S)[0], \mathrm{e}(S)[0]), \max(\mathrm{s}(S)[1], \mathrm{e}(S)[1])]$ | point Segment2D max

IF | $\wedge$ $\mathbf{p}_{lmin}[0] \leq \mathbf{p}_{smax}[0]$; $\mathbf{p}_{smin}[0] \leq \mathbf{p}_{lmax}[0]$; $\mathbf{p}_{lmin}[1] \leq \mathbf{p}_{smax}[1]$; $\mathbf{p}_{smin}[1] \leq \mathbf{p}_{lmax}[1]$

$a = \mathrm{s}(S)[1] - \mathrm{e}(S)[1]$

$b = \mathrm{s}(S)[0] - \mathrm{e}(S)[0]$

$s = 0$ | sign

$s+ = \mathrm{s}(a(\mathbf{p}_{lmin}[0] - \mathrm{e}(S)[0]) - b(\mathbf{p}_{lmin}[1] - \mathrm{e}(S)[1]))$

$s+ = \mathrm{s}(a(\mathbf{p}_{lmin}[0] - \mathrm{e}(S)[0]) - b(\mathbf{p}_{lmin}[1] - \mathrm{e}(S)[1]))$

$s+ = \mathrm{s}(a(\mathbf{p}_{lmax}[0] - \mathrm{e}(S)[0]) - b(\mathbf{p}_{lmin}[1] - \mathrm{e}(S)[1]))$

$s+ = \mathrm{s}(a(\mathbf{p}_{lmin}[0] - \mathrm{e}(S)[0]) - b(\mathbf{p}_{lmax}[1] - \mathrm{e}(S)[1]))$

$s+ = \mathrm{s}(a(\mathbf{p}_{lmax}[0] - \mathrm{e}(S)[0]) - b(\mathbf{p}_{lmax}[1] - \mathrm{e}(S)[1]))$

IF | $|s| < 4$ | $i_{ol} =$ TR

IF | $\vee$ $i_{ol} \equiv$ TR; $\wedge$ $i_{ol} \equiv$ FA; $i_{os} \equiv$ TR | $\mathrm{c}(L) = \mathrm{c}(P) + \mathrm{c}(\mathrm{r}(G)r, \mathrm{a}(\theta + \pi))$

$\mathcal{L}_c[\,] = L$

4.8.5 IF $o(L) \equiv F \in \mathcal{F}$

$d(L) = CM$			
$c(L) = c(F)$			
$\mathcal{A}_f = [\,]$	angle Face2D		
$n_i = 0$	number incidence		
1	FE	$P \in \mathcal{P}$	IF $c(L) \equiv c(P)$ → $n_i += 1$
			EI $0 < d(c(L), c(P)) \leq 1$ → $\mathcal{A}_f[\,] = a(c(L), c(P))$
	FE	$\wedge$ $L_1 \in \mathcal{L}$, $L_1 \neq L$	IF $c(L) \neq c(L_1)$ → $n_i += 1$
			EI $0 < d(c(L), c(L_1)) \leq 1$ → $\mathcal{A}_f[\,] = a(c(L), c(L_1))$
	IF	$\wedge$ $n_i \neq 0$, $\lvert\mathcal{A}_f\rvert \equiv 0$	$c(L) += [0, 1]$
	EI	$\lvert\mathcal{A}_f\rvert \neq 0$	$c(L) += c(1, amm(\mathcal{A}_f))$

4.9 겹치는 점선 한번에 표시

4.9.1 Arc2D

AR_d가 다음을 만족하도록 정렬	$a(c(AR_d[i]), s(AR_d[i])) \leq a(c(AR_d[i+1]), s(AR_d[i+1]))$		
$\mathcal{AR}_u = [\,]$	Arc2D union		
$\mathcal{AR}_o = [\,]$	Arc2D overlap		
1	FO	i	$A_u = \mathcal{AR}_d[i]$ Arc2D union
			$n_o = 0$ number overlap
			FO $i < j$ → IF $A_u \cap \mathcal{AR}_d[j] \in \mathcal{AR}$ → $A_u = A_u \cup \mathcal{AR}_d[j]$, $\mathcal{AR}_u[\,] = \mathcal{AR}_d[j]$, $n_o += 1$
			IF $n_o \neq 0$ → $\mathcal{AR}_u[\,] = A_u$, $\mathcal{AR}_o[\,] = \mathcal{AR}_d[i]$
$\mathcal{AR}_{uf} = [\,]$	Arc2D union filtered		
	FO	i	$n_c = 0$ number contained
			FO $j < i$ → IF $\mathcal{AR}_u[i] \subseteq \mathcal{AR}_u[j]$ → $n_c += 1$
			IF $n_c \equiv 0$ → $\mathcal{AR}_{uf}[\,] = \mathcal{AR}_u[j]$
$\mathcal{AR}_{uf}$의 모든 A 실선 표시			
$\mathcal{AR}_o$의 모든 A 보이지않게함			

4.9.2 Segment2D

- $\mathcal{S}_h = [\,]$ — Segment2D horizon
- $\mathcal{S}_{nh} = [\,]$ — Segment2D nonhorizon
- FE $S \in \mathcal{S}_d$
  - IF $\vee$ [$\mathrm{a}(S) \equiv 0$; $\mathrm{a}(S) \equiv \pi$] → $\mathcal{S}_h[\,] = S$
  - EL → $\mathcal{S}_{nh}[\,] = S$
- $\mathcal{S}_u = [\,]$ — Segment2D union
- $\mathcal{S}_o = [\,]$ — Segment2D overlap
- IF $|\mathcal{S}_h| \geq 2$
  - $\mathcal{S}_h$를 각 $S \in \mathcal{S}_h$ 좌표의 순서에 따라 오름차순 정렬
  - $\mathcal{K}_u = [\,]$ — $\mathcal{S}_h$에 있는 S중 사용한 S의 key — key used
  - FO $i \notin \mathcal{K}_u$
    - $S_u = \mathcal{S}_h[i]$
    - $i_o =$ FA — is overlap
    - FO $j > i$
      - IF $\wedge$ [$j \notin \mathcal{K}_u$; $S_u \cap \mathcal{S}_h[j] \in \mathcal{S}$]
        - $\mathcal{K}_u[\,] = j$
        - $S_u = S_u \cup \mathcal{S}_h[j]$
        - $\mathcal{S}_o[\,] = \mathcal{S}_h[j]$
        - $i_o =$ TR
    - IF $i_o \equiv$ TR
      - $\mathcal{S}_u[\,] = S_u$
      - $\mathcal{S}_o[\,] = \mathcal{S}_h[i]$
- 1 IF $|\mathcal{S}_{nh}| \geq 2$
  - $\mathcal{S}_h$를 각 $S \in \mathcal{S}_{nh}$ 좌표의 순서에 따라 오름차순 정렬
  - $\mathcal{K}_u = [\,]$ — $\mathcal{S}_{nh}$에 있는 S중 사용한 S의 key — key used
  - FO $i \notin \mathcal{K}_u$
    - $S_u = \mathcal{S}_{nh}[i]$
    - $i_o =$ FA
    - FO $j > i$
      - IF $\wedge$ [$j \notin \mathcal{K}_u$; $S_u \cap \mathcal{S}_{nh}[j] \in \mathcal{S}$]
        - $\mathcal{K}_u[\,] = j$
        - $S_u = S_u \cup \mathcal{S}_{nh}[j]$
        - $\mathcal{S}_o[\,] = \mathcal{S}_{nh}[j]$
        - $i_o =$ TR
    - IF $i_o \equiv$ TR
      - $\mathcal{S}_u[\,] = S_u$
      - $\mathcal{S}_o[\,] = \mathcal{S}_{nh}[i]$
- IF $|\mathcal{S}_u| \neq 0$
  - IF $|\mathcal{S}_u| \equiv 1$ → $\mathcal{S}_{uf} = \mathcal{S}_u$
  - EL
    - $\mathcal{S}_{uf} = [\,]$ — Segment2D union filtered
    - $\mathcal{K}_{uc} = [\,]$ — key union contained
    - FO $i \notin \mathcal{K}_{uc}$
      - $i_c =$ FA — is contained
      - FO j
        - IF $\mathcal{S}_u[i] \subseteq \mathcal{S}_u[j]$ → $i_c =$ FA
        - EI $\mathcal{S}_u[j] \subsetneq \mathcal{S}_u[i]$ → $\mathcal{K}_{uc}[\,] = j$
      - IF $i_c \equiv$ FA → $\mathcal{K}_{uc}[\,] = i$
  - FE $S \in \mathcal{S}_{uf}$ → S를 점선으로 표시
  - FE $S \in \mathcal{S}_o$ → S를 보이지않게함