

# istgame version 2.0: behind story

확장된 istgame 패키지

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# 1 Drawing game trees

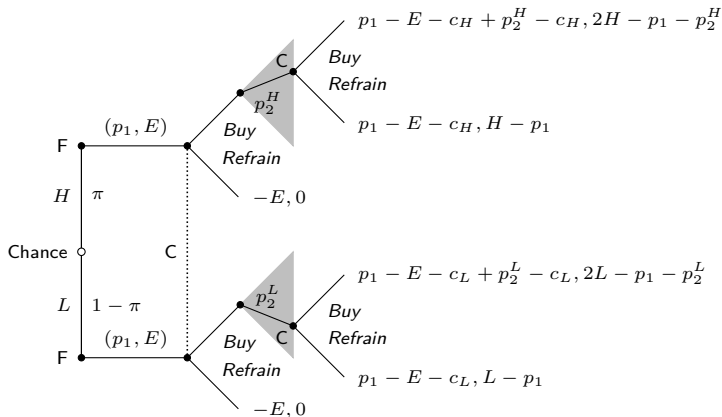
## 1.1 egameps and TikZ tree library

- The egameps package

- Martin J. Osborne,

- An Introduction to Game Theory*

- A Course in Game Theory* (with Ariel Rubinstein)

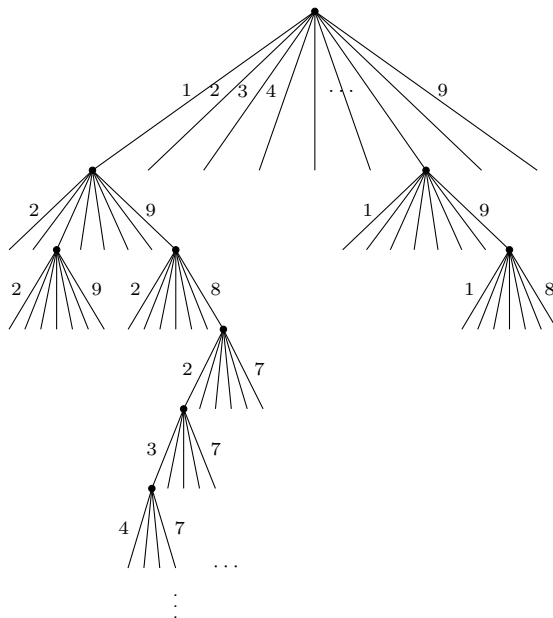


- TikZ tree library

- Haiyun K. Chen (2013)

## 1.2 why istgame?

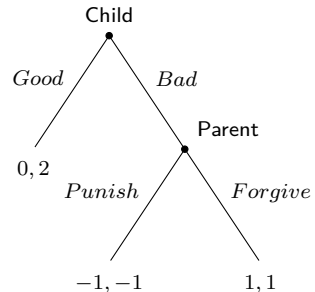
- xelatex and pstricks: too much time
- efficiency, game theoretic logic, readability, code resusability



2 **istgame version 1.0**

## 2.1 parent-child game

```
\begin{istgame}[font=\scriptsize]
\xtdistance{15mm}{20mm}
\istroot(0){Child}
  \istb{Good}[al]{0,2}
  \istb{Bad}[ar]
\endist
\istroot(1)(0-2)<45>{Parent}
  \istb{Punish}[al]{-1,-1}
  \istb{Forgive}[ar]{1,1}
\endist
\end{istgame}
```





## 2.2 history

### KTUG 게시판, 게임 트리 그리기 시리즈

- 2015년 5월, 6월
- lshort.pdf 번역 관련, 게시판이 뜨거울 때...
- 게시판 분위기 전환을 위해...

### simple tree: xparse

- (2015.06.09.) 게임 트리 그리기 1: [http://www.ktug.org/xe/index.php?document\\_srl=207287](http://www.ktug.org/xe/index.php?document_srl=207287)
- (2015.06.10.) 게임 트리 그리기 1-1: [http://www.ktug.org/xe/index.php?document\\_srl=207513](http://www.ktug.org/xe/index.php?document_srl=207513)
- (2015.06.15.) 게임 트리 그리기 1-2: [http://www.ktug.org/xe/index.php?document\\_srl=208286](http://www.ktug.org/xe/index.php?document_srl=208286)
- (2015.08.14.) 게임 트리 그리기 2: [http://www.ktug.org/xe/index.php?document\\_srl=212043](http://www.ktug.org/xe/index.php?document_srl=212043)
- simple tree로 게임 트리를 그리지만,  
패키지로 묶으면 안된다...  
expl3로 해결할 수 없을까...

## 대청호에서 무슨 일이...

- 2015년 8월 15일 주말
- 대청호, 커피 한 잔...

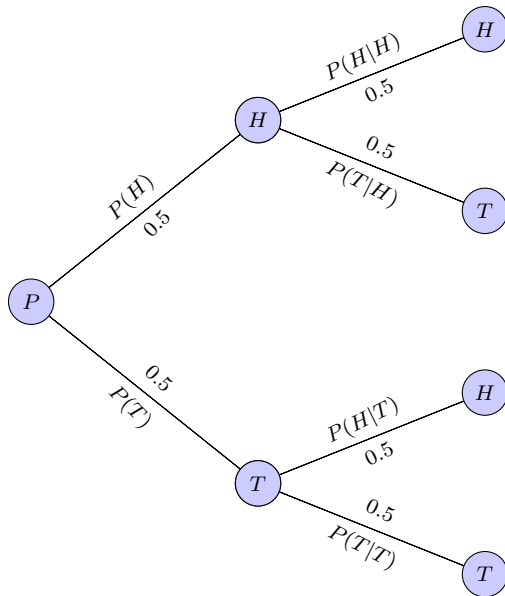
## `\istdone: expl3`

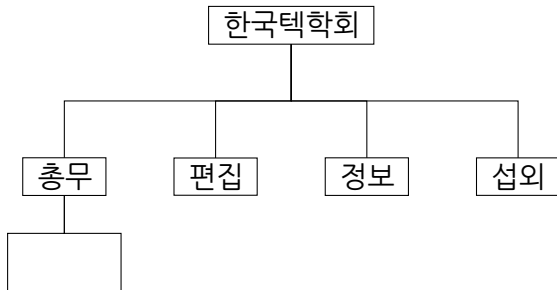
- (2015.08.17.) Drawing Game Trees 2-1: [http://www.ktug.org/xe/index.php?document\\_srl=212225](http://www.ktug.org/xe/index.php?document_srl=212225)
- (2015.08.20.) `ischogame.tex`
  - `\istroot`
  - `\istbranch`
  - `\istdone`
- (2015.08.18.) Drawing Game Trees 2-2: [http://www.ktug.org/xe/index.php?document\\_srl=212319](http://www.ktug.org/xe/index.php?document_srl=212319)
- (2015.09.02.) 게임트리 그리기 시리즈 결론: [http://www.ktug.org/xe/index.php?document\\_srl=213014](http://www.ktug.org/xe/index.php?document_srl=213014)

## istgame.sty

- (2015.08.29.) istgame.sty v0.1(약 150행): KTUG 사설저장소 등록
  - simple tree structure 확정
    - \* \istroot
    - \* \istb
    - \* \endist ← \istdone
  - 문서: istgame-doc.pdf(20쪽)
- 뒤엎고, 또 뒤엎기...
  - core macros, 인자 순서
  - node style
  - continuum of branches
  - information sets
  - show/hide points
  - abbreviations...
- (2017.09.04.) istgame v1.0 마감(약 800행), 테스트, 매뉴얼 보완(55쪽)
- (2017.09.26.) istgame v1.0 CTAN 등록

## 2.3 applications: non-game-theoretic



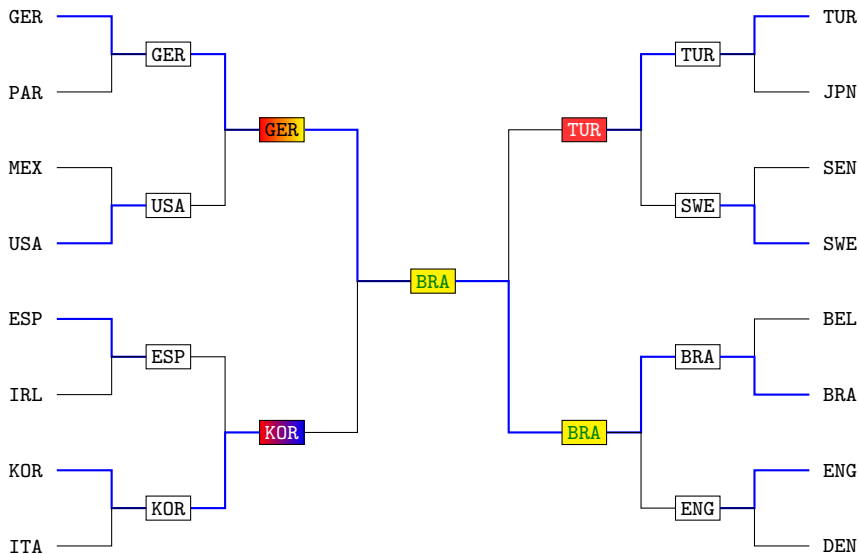


```

\begin{istgame}[edge from parent fork down]
\setistNewNodeStyle{org}[rectangle,inner sep=2pt,minimum size=3mm]
\xtddistance{20mm}{20mm}
\istrooto(0)[org]{ 한국텍학회~ }
\istb \istb \istb \istb \endist
\xtddistance{15mm}{15mm}
\istrooto(1)(0-1)[org]{ 총무~ }
\istb \istb \endist
\istrooto(1)(0-2)[org]{ 편집~ } \endist
\istrooto(1)(0-3)[org]{ 정보~ } \endist
\istrooto(1)(0-4)[org]{ 섭외~ } \endist
\end{istgame}

```

# 2002 WORLD CUP!



edge from parent fork left

edge from parent fork right

3 **istgame version 2.0**

## 3.1 why version 2?

### Why?

- Osborne의 책에 나오는 모든 게임을 그릴 수 있는데, 왜?
- TODO list
- something inconvenient even to me
- <https://tex.stackexchange.com>에 대한 답변

가장 큰 문제는, expansion...

### New features

- `\xtInfoset0`
- `\istrootcntm`, `\istrootcntmA`
- `\istbA`
- `\xtCInfoset`, `\xtCInfoset0`
- `\cntmAInfoset`, `\cntmAInfoset0`
- `\setistmathTF(*)` ... expansion 문제 해결의 부산물
- middle arrow tip styles
- ant others

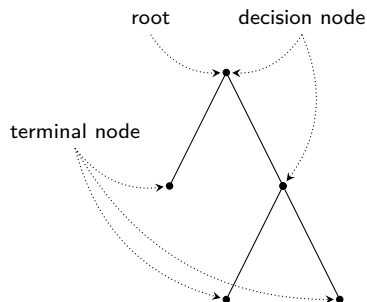


### 3.2 \xtCommentTo and \xtCommentFrom

\xtCommentTo(coor1)(coor2) : 상대좌표 (coor2)로부터 (coor1)으로...

\xtCommentFrom(coor1)(coor2): 절대좌표 (coor1)으로부터 (coor2)로...

```
\begin{istgame}[font=\scriptsize]
\xtShowEndPoints
\istroot(0)
  \istb \istb \endist
\istroot(1)(0-2)
  \istb \istb \endist
\xtCommentTo[bend right](0)(-1,.5){root}
\xtCommentFrom[bend left](1,.5)(0)
  {decision node}
\xtCommentFrom[bend left](1,.5)(1)
\xtCommentFrom[bend right](-2,-1)(0-1)
  {terminal node}
\xtCommentFrom[bend right](-2,-1)(1-1)
\xtCommentFrom[bend right](-2,-1)(1-2)
\end{istgame}
```

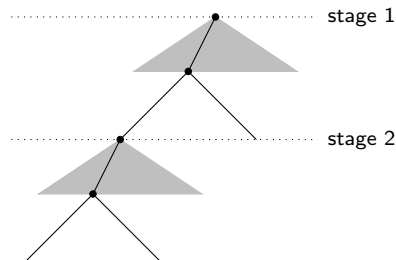


### 3.3 `\xtTimeLineH` and `\xtTimeLineV`

```

\begin{istgame}[scale=.9,font=\scriptsize]
\xtdistance{10mm}{20mm}
\istrootcntm(x1) \istb \istbm \endist
\istroot(y1)(x1-1) \istb \istb \endist
\istrootcntm(y2)(y1-1) \istb \istbm \ endist
\istroot(x2)(y2-1) \istb \istb \ endist
\xtTimeLineH(x1){-3}{1.5}{stage 1}
\xtTimeLineH(y2){-3}{1.5}{stage 2}
\end{istgame}

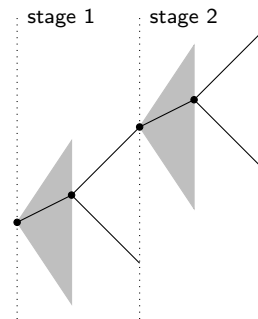
```



```

\begin{istgame}[scale=.9,font=\scriptsize]
\setistgrowdirection' {east}
\xtdistance{10mm}{20mm}
\istrootcntm(x1) \istb \istbm \ endist
\istroot(y1)(x1-1) \istb \istb \ endist
\istrootcntm(y2)(y1-1) \istb \istbm \ endist
\istroot(x2)(y2-1) \istb \istb \ endist
\xtTimeLineV(x1){3}{-1.5}{stage 1}
\xtTimeLineV(y2){3}{-1.5}{stage 2}
\end{istgame}

```



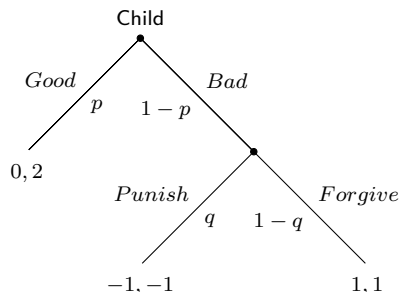
### 3.4 \istB: dual labels

\istb + \xtActionLabel

or

\istB

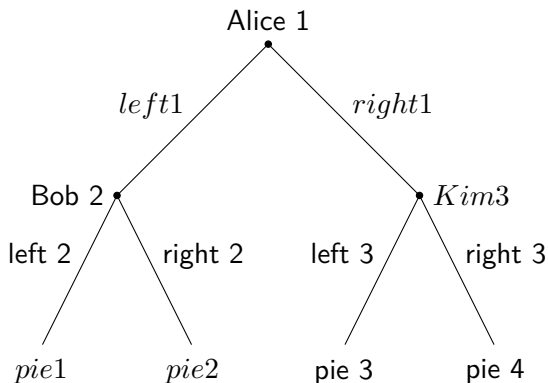
```
\begin{istgame}[font=\scriptsize]
\xtdistance{15mm}{30mm}
% \istB
\istroot(0){Child}
  \istB{Good}[al]{p}[br]{0,2}
  \istB{Bad}[ar]{1-p}[bl]
\endist
% \istb + \xtActionLabel
\istroot(1)(0-2)
  \istb{Punish}[al]{-1,-1}
  \istb{Forgive}[ar]{1,1}
\endist
\xtActionLabel(1)(1-1){q}[br]
\xtActionLabel(1)(1-2){1-q}[bl]
\end{istgame}
```



opportunity cost: \istb.  $\rightarrow$  \istbt (terminal version)

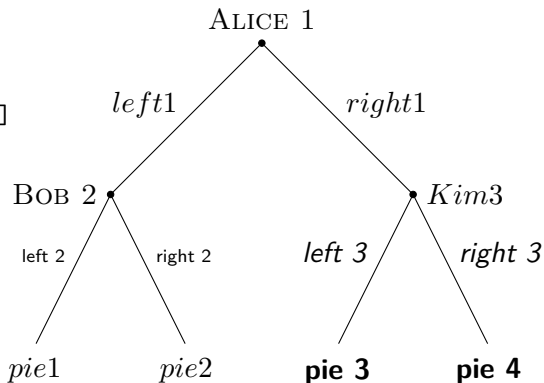
### 3.5 \setistmathTF: input mode changer

```
\begin{istgame}
%\setistmathTF011 % (default)
\xtdistance{20mm}{20mm}
\istroot(0){Alice 1}+20mm..40mm+
  \istb{left 1}[al]
  \istb{right 1}[ar]
\endist
\setistmathTF001
\istroot(1)(0-1)<180>{Bob 2}
  \istb{left 2}[al]{pie 1}
  \istb{right 2}[ar]{pie 2}
\endist
\setistmathTF100
\istroot(2)(0-2)<0>{Kim 3}
  \istb{left 3}[al]{pie 3}
  \istb{right 3}[ar]{pie 4}
\endist
\end{istgame}
```



### 3.6 \setistmathTF\*: input mode and text font style changer

```
\begin{istgame}
\xtdistance{20mm}{20mm}
\setistmathTF*011<textsc>{tiny}[textbf]
\istroot(0){Alice 1}+20mm..40mm+
  \istb{left 1}[al]
  \istb{right 1}[ar]
\endist
\setistmathTF*001<textsc>{tiny}[textbf]
\istroot(1)(0-1)<180>{Bob 2}
  \istb{left 2}[al]{pie 1}
  \istb{right 2}[ar]{pie 2}
\endist
% actions labels in italics (by
% default)
\setistmathTF*100[textbf]
\istroot(2)(0-2)<0>{Kim 3}
  \istb{left 3}[al]{pie 3}
  \istb{right 3}[ar]{pie 4}
\endist
\end{istgame}
```

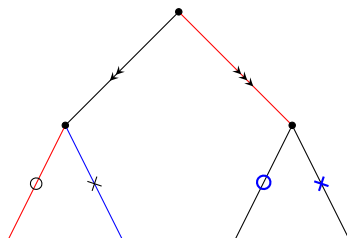


### 3.7 middle arrow tip styles

fixed styles:

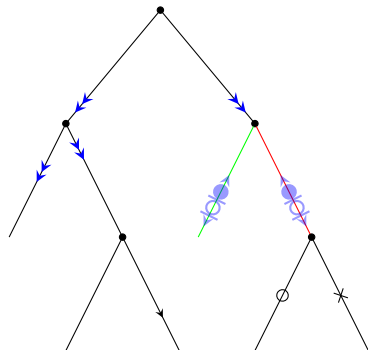
- `->>-` : double arrow tip
- `->>>-` : triple arrow tip
- `-o-` : circle arrow tip
- `-x-` : cross arrow tip

```
\begin{istgame}
\istroot(0)+15mm..30mm+
  \istb[->>-]    \istb[->>>- ,red]
  \endist
\istroot(1)(0-1)
  \istb[-o-,red] \istb[-x-,blue]
  \endist
\setxtarrowtips[blue,thick]
\istroot(2)(0-2)
  \istb[-o-]    \istb[-x-]
  \endist
\end{istgame}
```

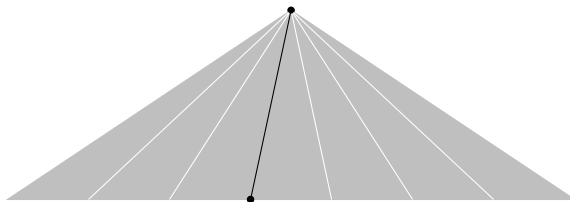


### 3.8 `->-` and `\setxtarrowtips`

```
\begin{istgame}
\setxtarrowtips<.9>{>>}[blue,thick]
\istroot(0)+15mm+.25mm+
  \istb[->-] \istb[->-]
\endist
\istroot(1)(0-1)
  \istb[->=].5] \istb[->=].3]
\endist
\setxtarrowtips<.9>{<*\!o|>}
[blue,thick,opacity=.4]
\istroot(2)(0-2)
  \istb[->-,green] \istb[->-,red]
\endist
%-----
\setxtarrowtips<.7>
\istroot(3)(1-2) \istb \istb[->-]
\endist
\istroot(4)(2-2) \istb[-o-] \istb[-x-]
\endist
\end{istgame}
```



### 3.9 continuum of branches: `\istrootcntm`



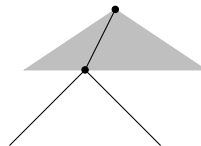
old way:

```
\istcntm(cntm)(0,0)  
\istoot(0)(cntm)
```

new way: `\istroot + cntm`

```
\istrootcntm(0)(0,0)
```

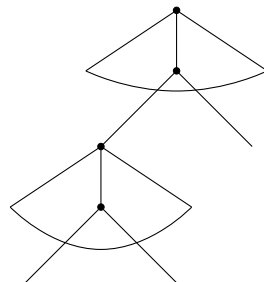
```
\begin{istgame}  
\xtdistance{10mm}{20mm}  
\istrootcntm(0) \istb \istbm \endist  
\istroot(1)(0-1) \istb \istb \endist  
\end{istgame}
```



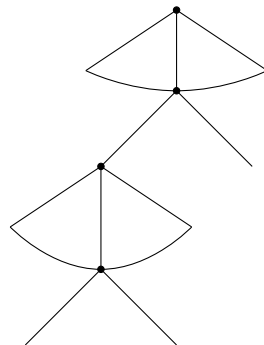


### 3.10 `\istrootcntmA` and `\istbA`

```
% \istroot + cntmA
\begin{istgame}
\xtdistance{10mm}{20mm}
\istrootcntmA(0) \istb \endist
\istroot(1)(0-1) \istb \istb \endist
\cntmApreset<1.7>
\istrootcntmA(2)(1-1) \istb \ endist
\istroot(3)(2-1) \istb \istb \ endist
\end{istgame}
```

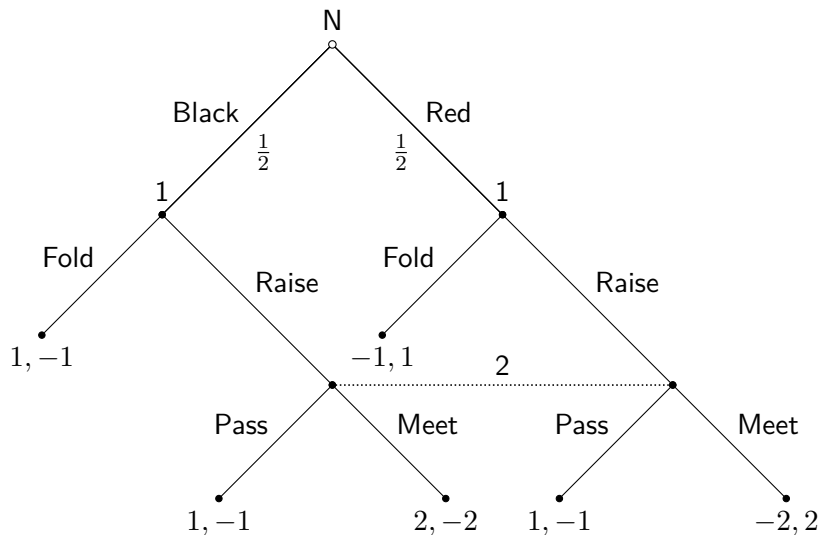


```
% \istbA
\begin{istgame}
\xtdistance{10mm}{20mm}
\istrootcntmA(0) \istbA \ endist
\istroot(1)(0-1) \istb \istb \ endist
\cntmApreset<1.7>
\istrootcntmA(2)(1-1) \istbA \ endist
\istroot(3)(2-1) \istb \istb \ endist
\end{istgame}
```



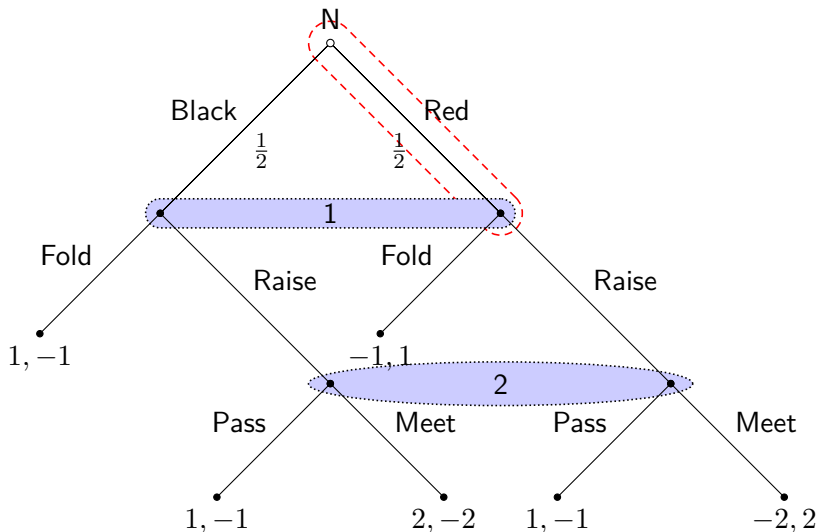
## 4 Information sets

## 4.1 information sets



information set:  $\text{\xtInfoset}(\text{coor1})(\text{coor2})$

## 4.2 \xtInfoset0: enhanced



`\xtInfoset0(coor1)(coor2)`

`\n1 + 1em`

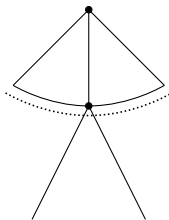
sloped, direction-free, swap-free, scale-free, shape (ellipse, etc.)

`\setxtinfosetlayer{background}` : behind, main, above, foreground

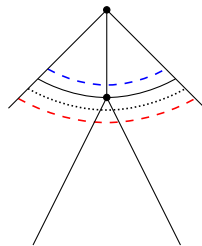
### 4.3 \cntmAInfoset

2018년 12월 초, 메일 한 통...

```
\begin{istgame}
\cntmdistance{10mm}{20mm}
\istrootcntmA(0) \istbA \endist
\cntmAInfoset(0)
\istroot(1)(0-1) \istb \istb \endist
\end{istgame}
```



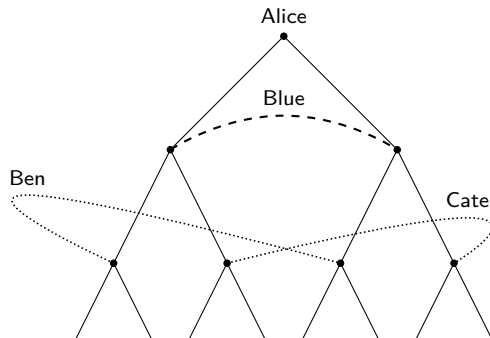
```
\begin{istgame}[scale=1.3]
\cntmdistance{10mm}{20mm}
\cntmApreset{.7}
\istrootcntmA(0) \istbA \ endist
\cntmAInfoset(0)
\cntmAInfoset[blue,dashed](0){-.1}
\cntmAInfoset[red,dashed](0){.2}
\istroot(1)(0-1) \istb \istb \ endist
\end{istgame}
```



옆고, 또 옆고... 그럭저럭... \cntmAInfoset0

## 4.4 \xtCInfoset: curved information set

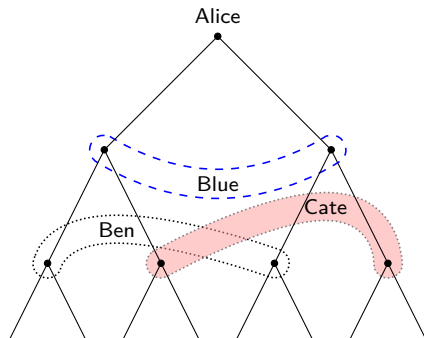
```
\begin{istgame}[font=\scriptsize]
\istroot(0){Alice}+15mm..30mm+
  \istb \istb \endist
\istroot(1)(0-1)
  \istb \istb \endist
\istroot(2)(0-2)
  \istb \istb \endist
\xtdistance{10mm}{10mm}
\istroot(3)(1-1)
  \istb \istb \endist
\istroot(4)(1-2)
  \istb \istb \endist
\istroot(5)(2-1)
  \istb \istb \endist
\istroot(6)(2-2)
  \istb \istb \endist
\xtCInfoset[dashed,thick](1)(2){Blue}
\xtCInfoset(1-1)!-.05!(2-1)<1.6>{Ben}
\xtCInfoset(1-2)!.9!(2-2)<1.4>{Cate}
\end{istgame}
```

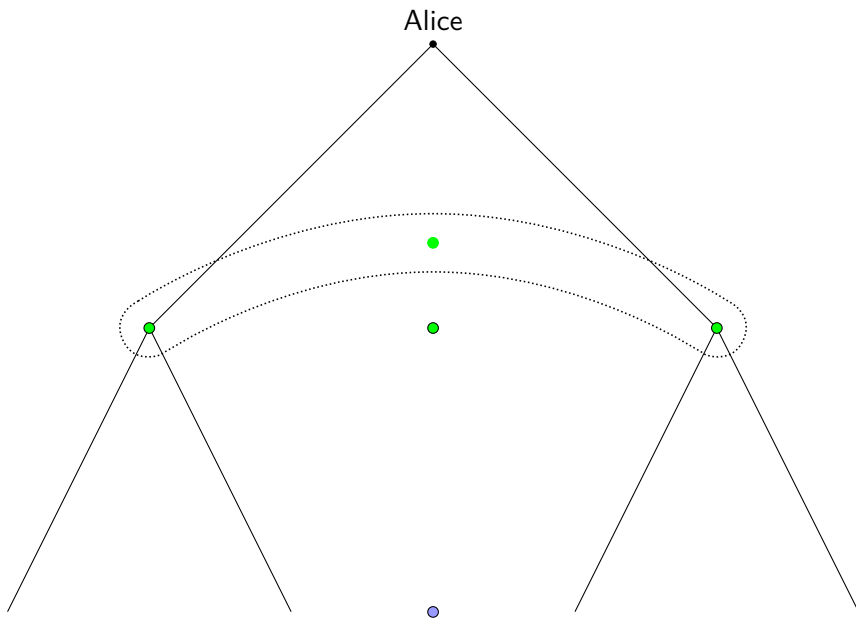


direction-free, scale-free, swap-free...

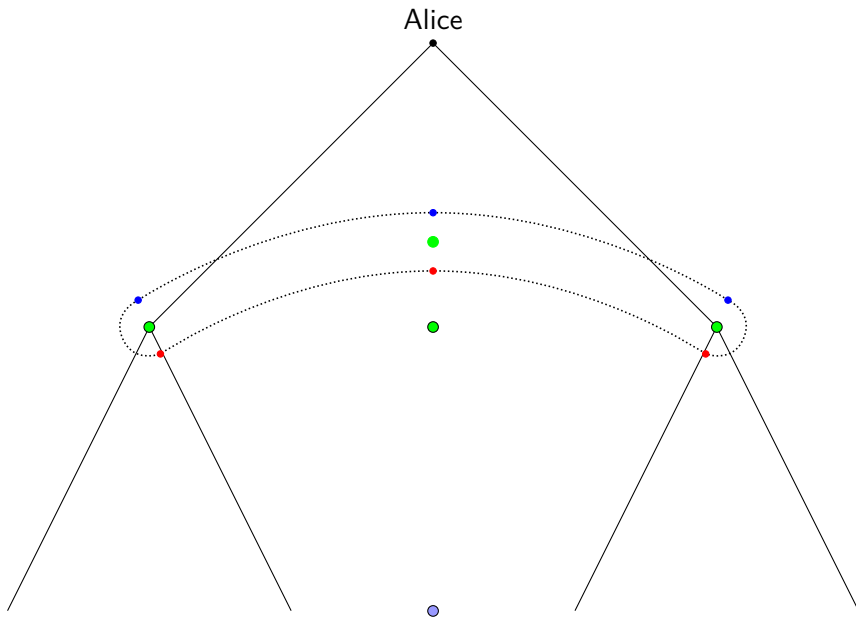
## 4.5 \xtCInfoset0: curved bubble type

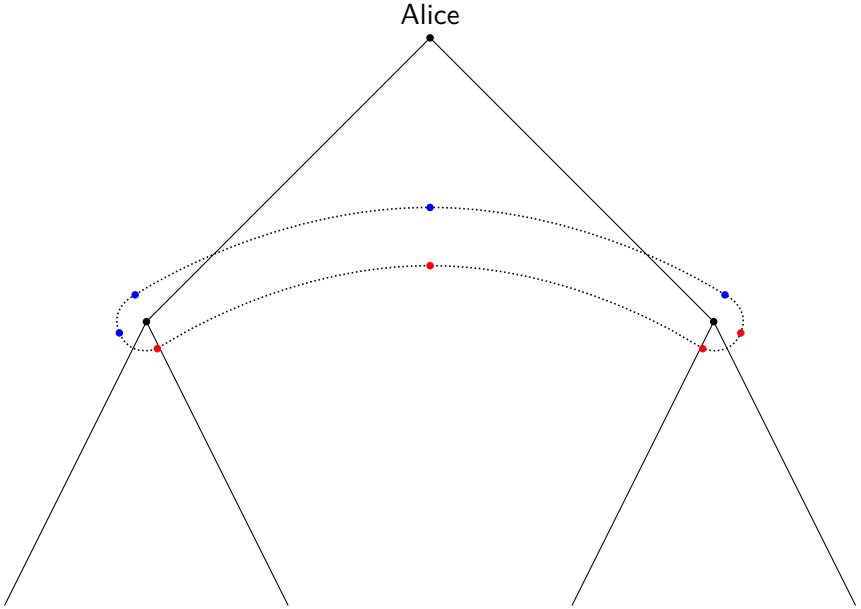
```
\begin{istgame}[font=\scriptsize]
\istroot(0){Alice}+15mm..30mm+
  \istb \istb \endist
\istroot(1)(0-1)
  \istb \istb \endist
\istroot(2)(0-2)
  \istb \istb \endist
\xtdistance{10mm}{10mm}
\istroot(3)(1-1)
  \istb \istb \endist
\istroot(4)(1-2)
  \istb \istb \endist
\istroot(5)(2-1)
  \istb \istb \endist
\istroot(6)(2-2)
  \istb \istb \endist
\xtCInfoset0[dashed,blue](1)(2)<.7>{Blue}
\xtCInfoset0(1-1)!.35!(2-1){Ben}
\xtCInfoset0[fill=red!40,opacity=.5]
  (1-2)!.65!(2-2)<1.5>{Cate}
\end{istgame}
```

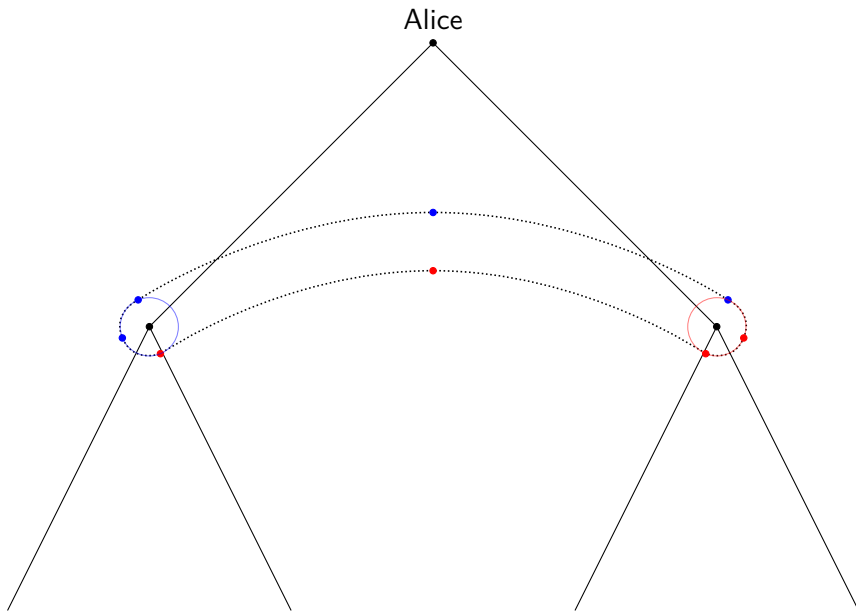


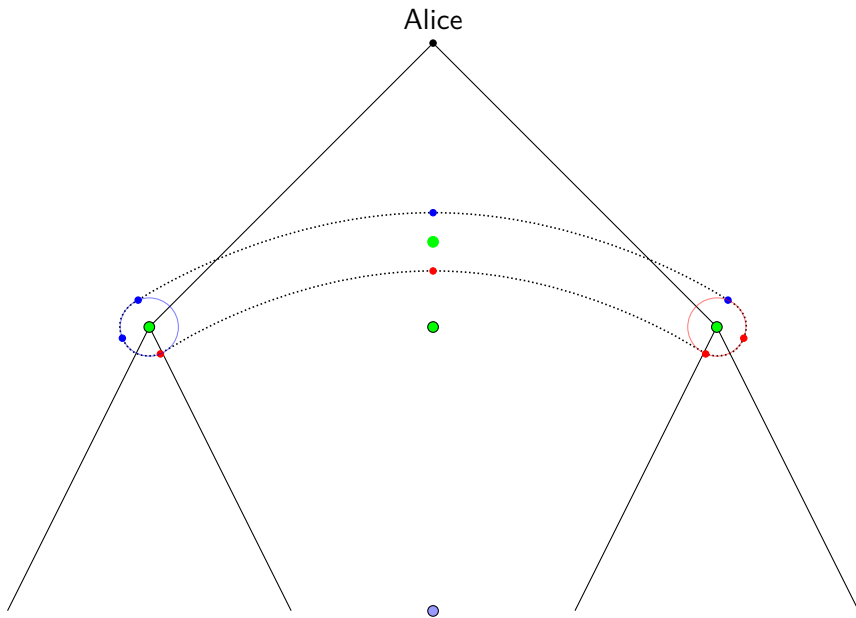






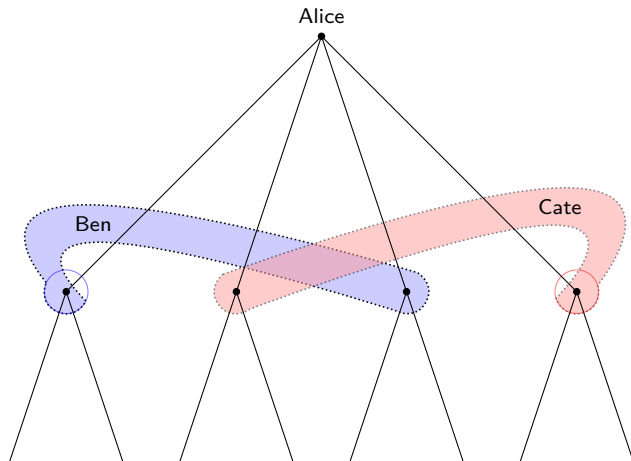






## extreme values

```
\xtCInfoset0[fill=blue!20](1)!.2!(3)<1.4>{Ben}(1.5em)  
\xtCInfoset0[fill=red!40,opacity=.5](2)!.8!(4)<1.5>{Cate}(1.5em)
```



...circles drawn by `\xtshowXpoints` (not documented)

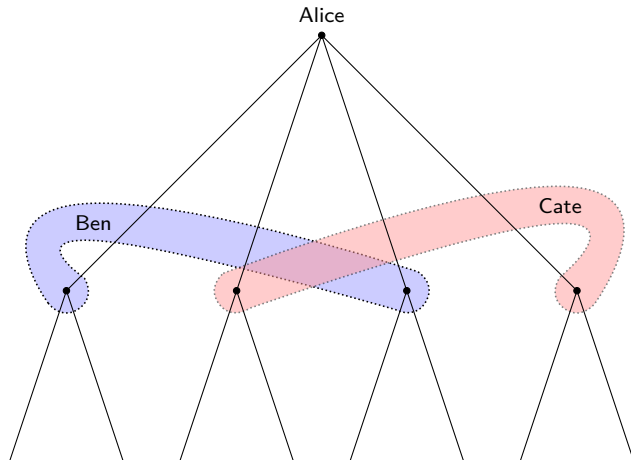
\xtCInfoset0TurnX

```
\xtCInfoset0TurnX{60}{0}
```

```
\xtCInfoset0[fill=blue!20](1)!.2!(3)<1.4>{Ben}(1.5em)
```

```
\xtCInfoset0TurnX{0}{-55}
```

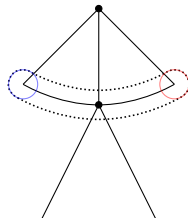
```
\xtCInfoset0[fill=red!40,opacity=.5](2)!.8!(4)<1.5>{Cate}(1.5em)
```



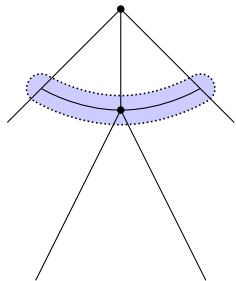
## 4.6 \cntmAInfoset0

결국 또 얹고...

```
\begin{istgame}  
\cntmdistance{10mm}{20mm}  
\istrootcntmA(0) \istbA \endist  
\xtshowXpoints03  
\cntmAInfoset0(0)  
\istroot(1)(0-1) \istb \istb \endist  
\end{istgame}
```



```
\begin{istgame}[scale=1.5]  
\cntmdistance{10mm}{20mm}  
\cntmApreset{.7}  
\istrootcntmA(0) \istbA \endist  
\cntmAInfoset0[fill=blue!20](0)  
\istroot(1)(0-1) \istb \istb \ endist  
\end{istgame}
```



## 5 Concluding remarks

- Questions
- No more updates
- Fork-like game trees

Thank you!