Übungsbeispiel α-β-Algorithmus

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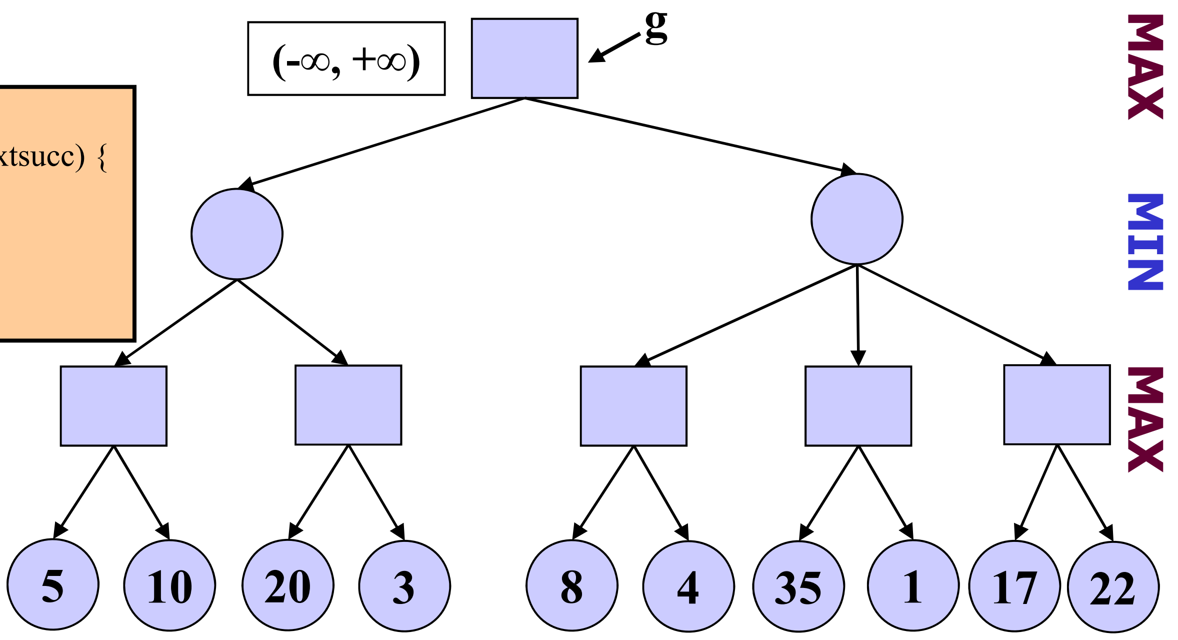
Übungsbeispiel α-β-Algorithmus

- Illustriert auf 75 Folien Schritt für Schritt den Ablauf des α-β-Algorithmus

```
int maxValue(Gamestate g, int α, int β) {
  if cutofftest(g) return eval(g);
  for (GameState s=g.firstsucc; s!=g.lastsucc; s=s.nextsucc) {
    α = max(α, minValue(s, α, β) );
    if (α >= β) break; // β-Schnitt
  }
  return α;
}

int minValue(Gamestate g, int α, int β) {
  if cutofftest(g) return eval(g);
  for (GameState s=g.firstsucc; s!=g.lastsucc; s=s.nextsucc) {
    β = min(β, maxValue(s, α, β) );
    if (β <= α) break; // α-Schnitt
  }
  return β;
}
```

```
maxValue(g, - ∞,+ ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

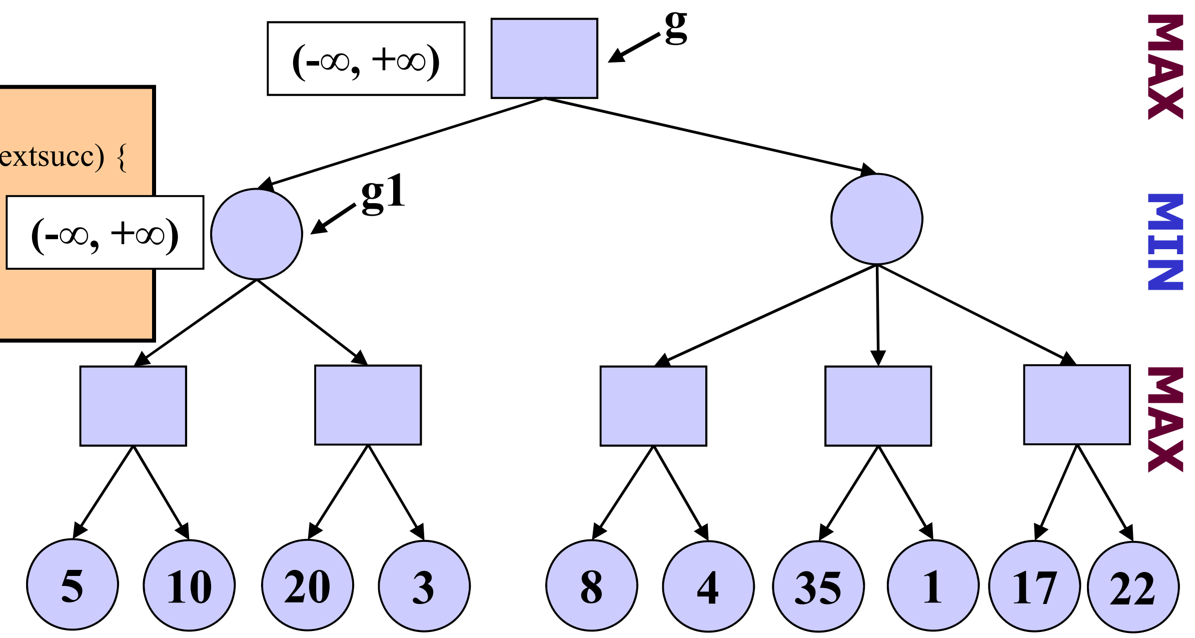


maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞));
        if ( β ≤ -∞ ) break;
}
return β;
```



maxValue(g, - ∞,+ ∞)

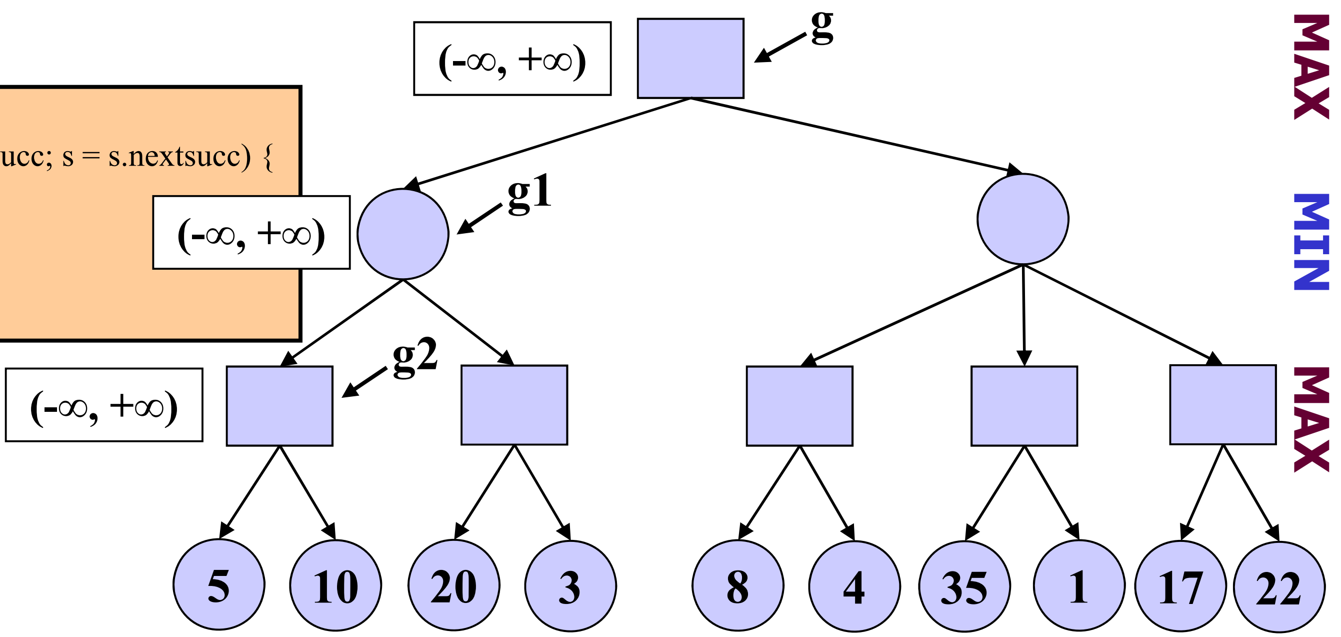
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

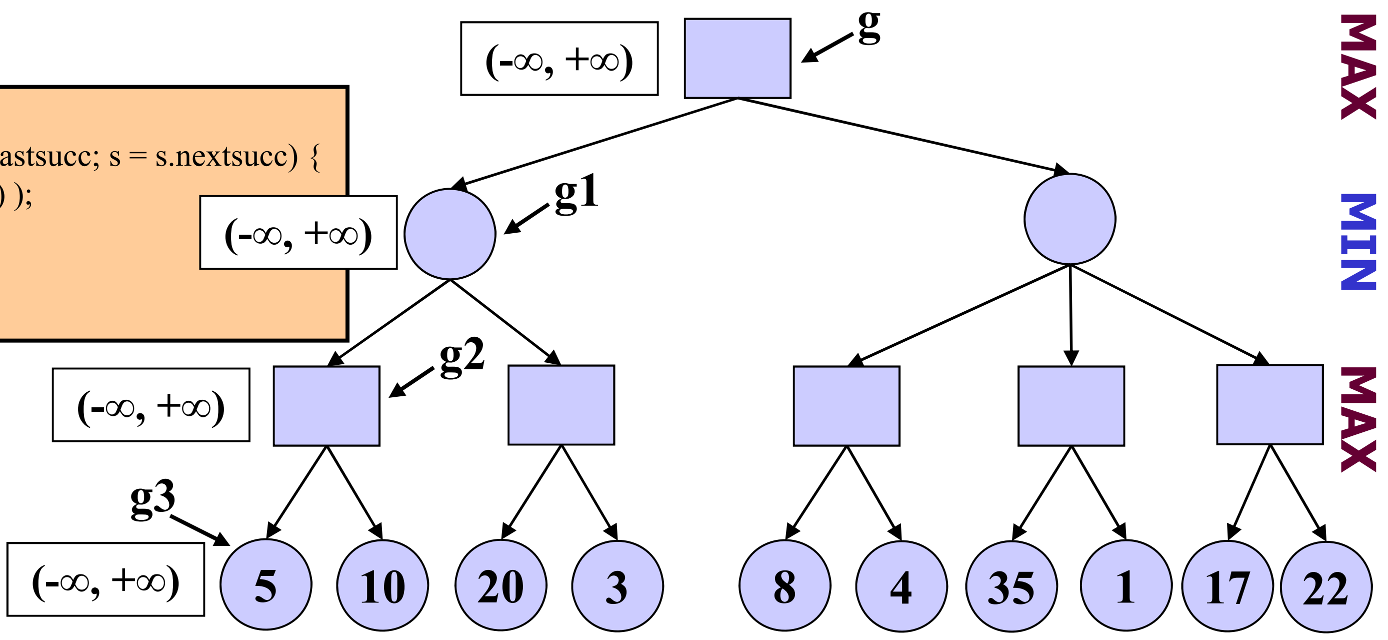
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞));
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , minValue(s, -∞, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```





maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞));
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , minValue(s, -∞, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

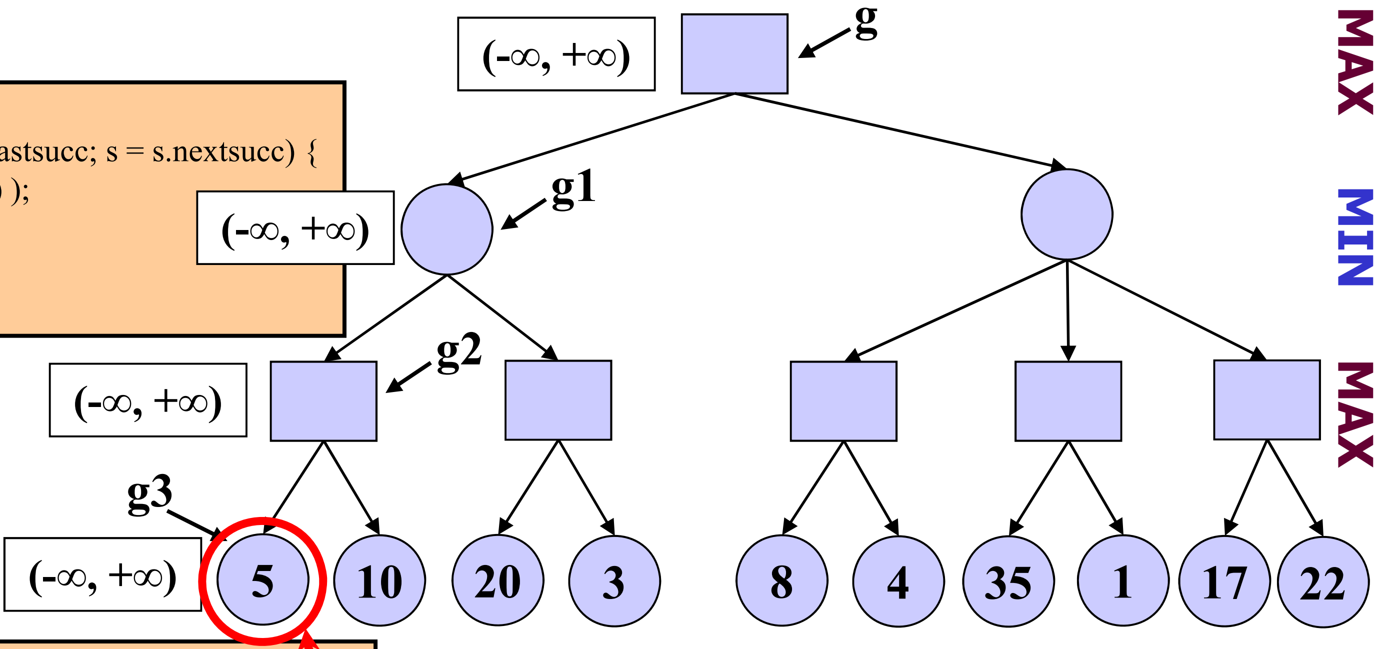
minValue(g3, -∞, +∞)

```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞));
        if ( β  ≤ -∞ ) break;
}
return β;
```

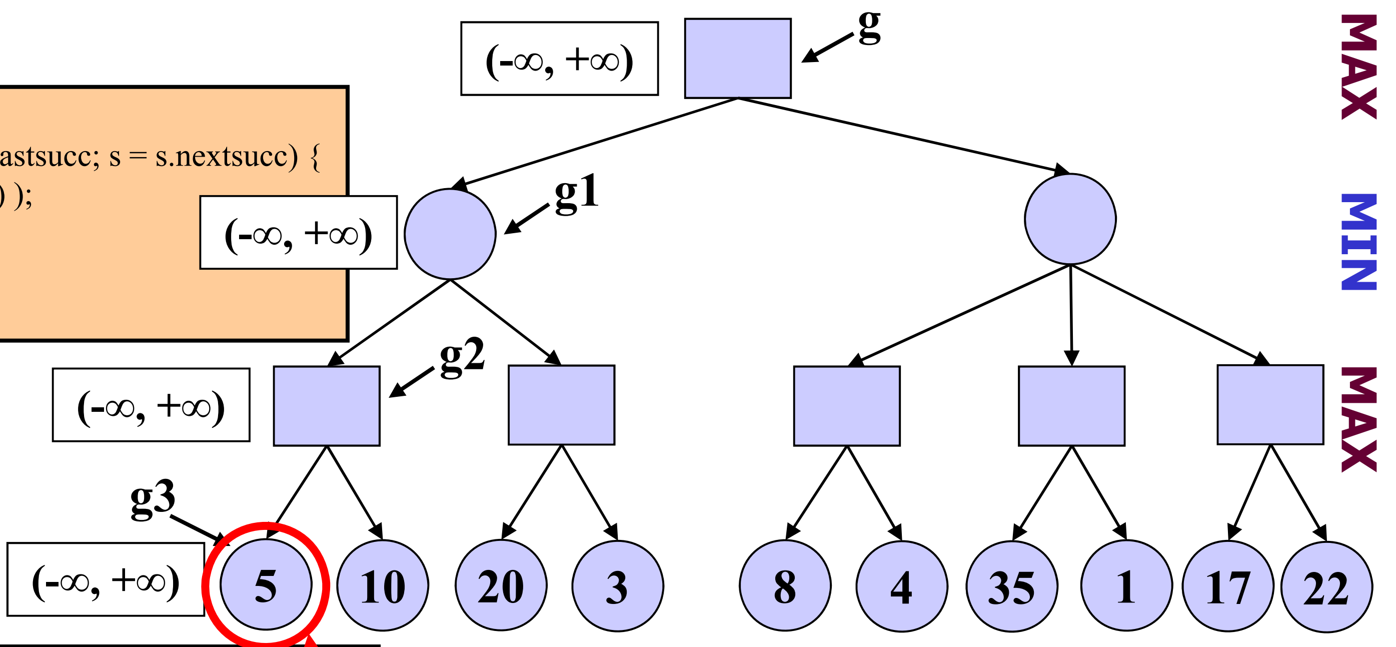
```
maxValue(g2,-∞, +∞)
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , minValue(s, -∞, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

```
minValue(g3, -∞, +∞)
cutofftest(g3)) → true!!
```



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞));
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , minValue(s, -∞, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g3, -∞, +∞)

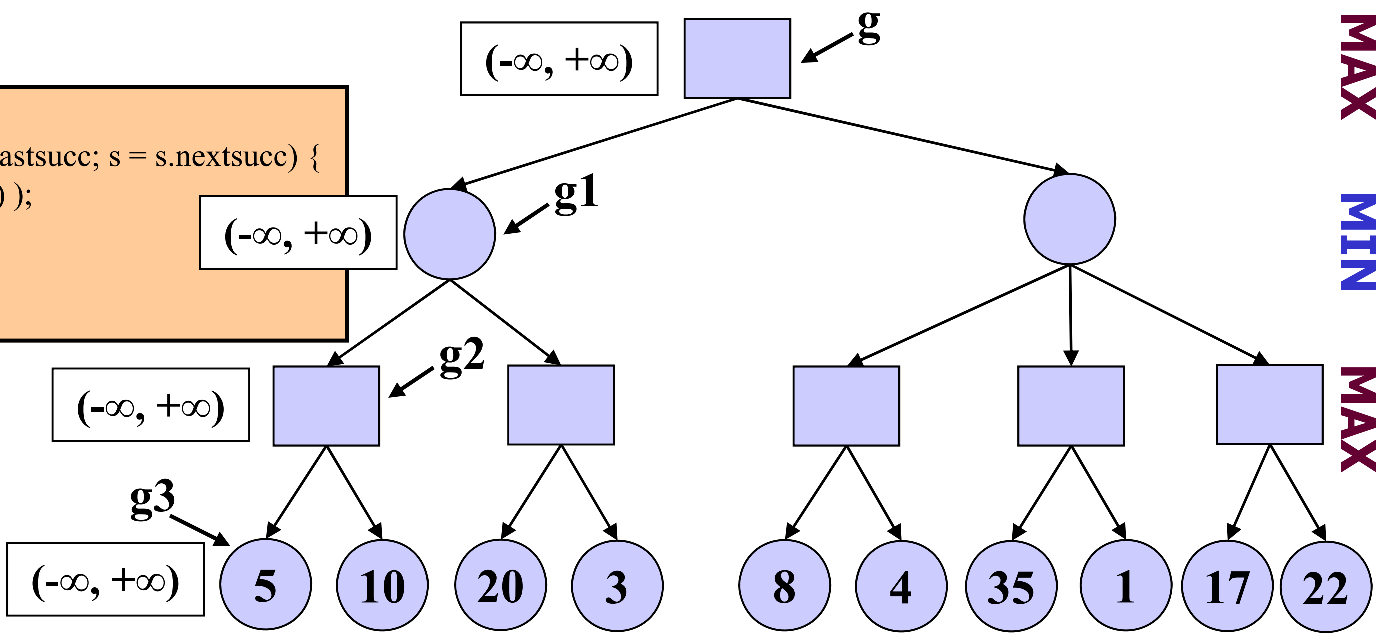
```
cutofftest(g3)) → true!!
⇒ eval(g3) = 5
⇒ return 5
```

```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

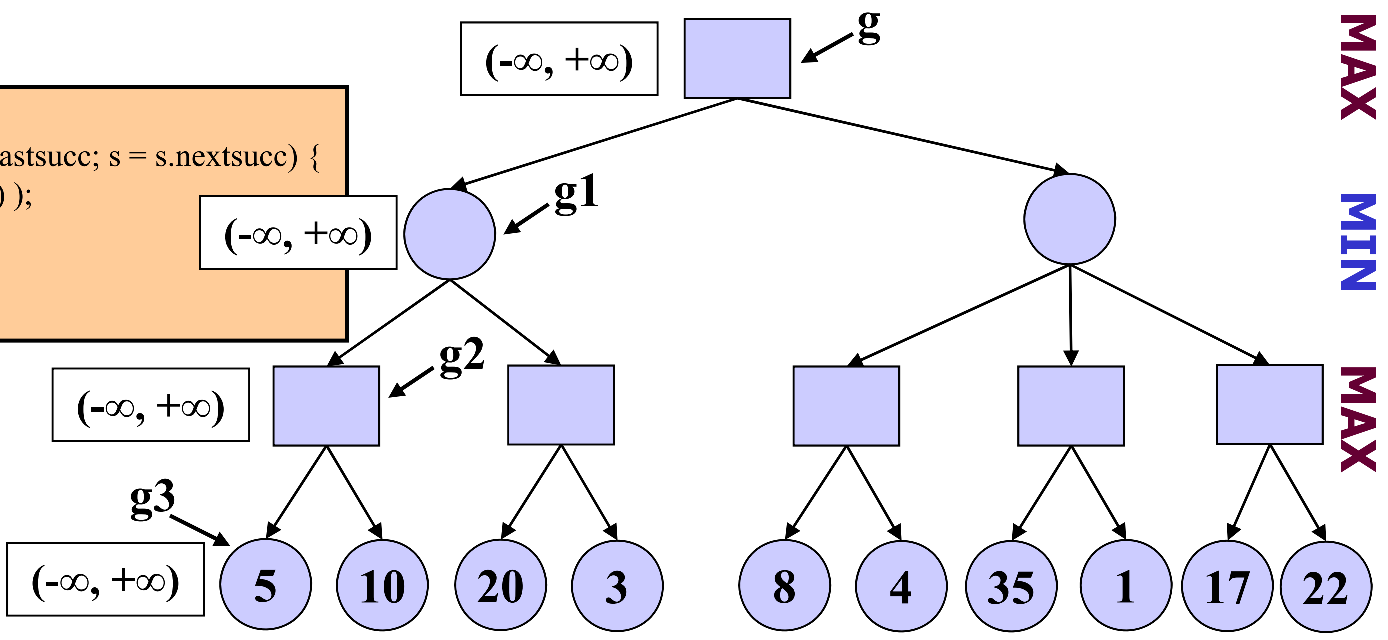
```
maxValue(g2,-∞, +∞)
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , minValue(s, -∞, +∞) );
        if ( α  ≥  +∞ ) break;
}
return α;
```

```
minValue(g3, -∞, +∞)
cutofftest(g3)) → true!!
⇒ eval(g3) = 5
⇒ return 5
```



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```



minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , 5 );
        if ( α ≥ +∞ ) break;
}
return α;
```

minValue(g3, -∞, +∞)

```
cutofftest(g3)) → true!!
⇒ eval(g3) = 5
⇒ return 5
```

maxValue(g, - ∞,+ ∞)

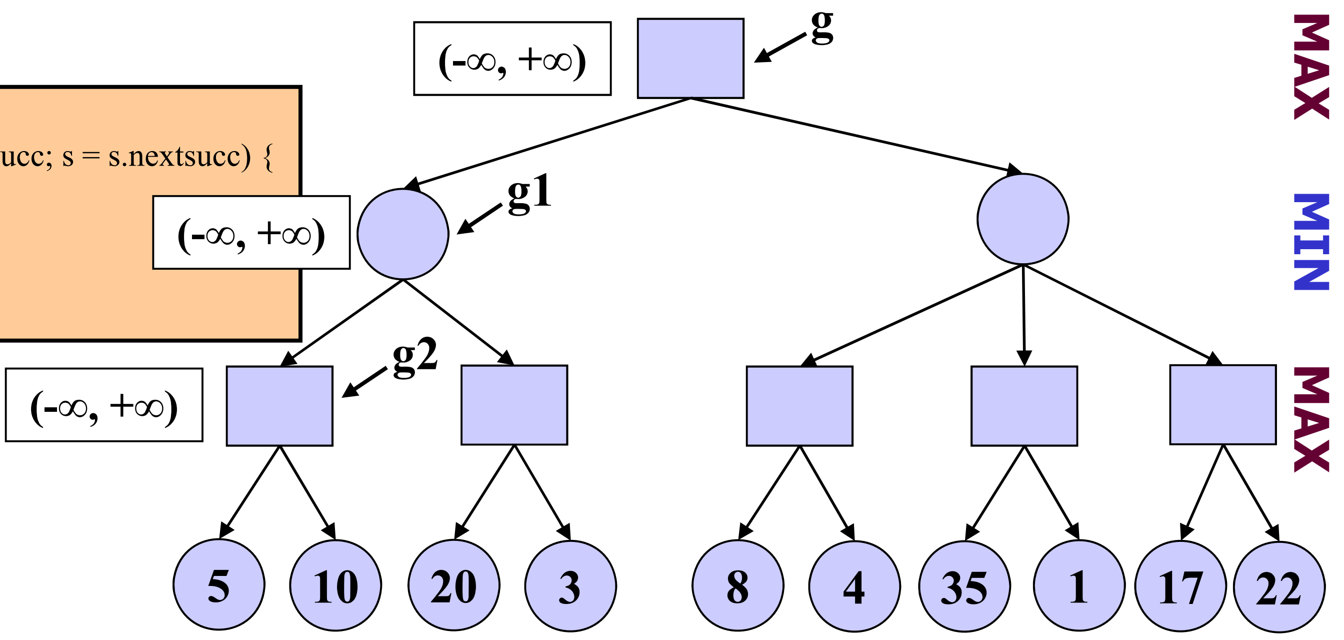
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( -∞ , 5 );
        if ( α  ≥ +∞ ) break;
}
return α;
```



maxValue(g, - ∞,+ ∞)

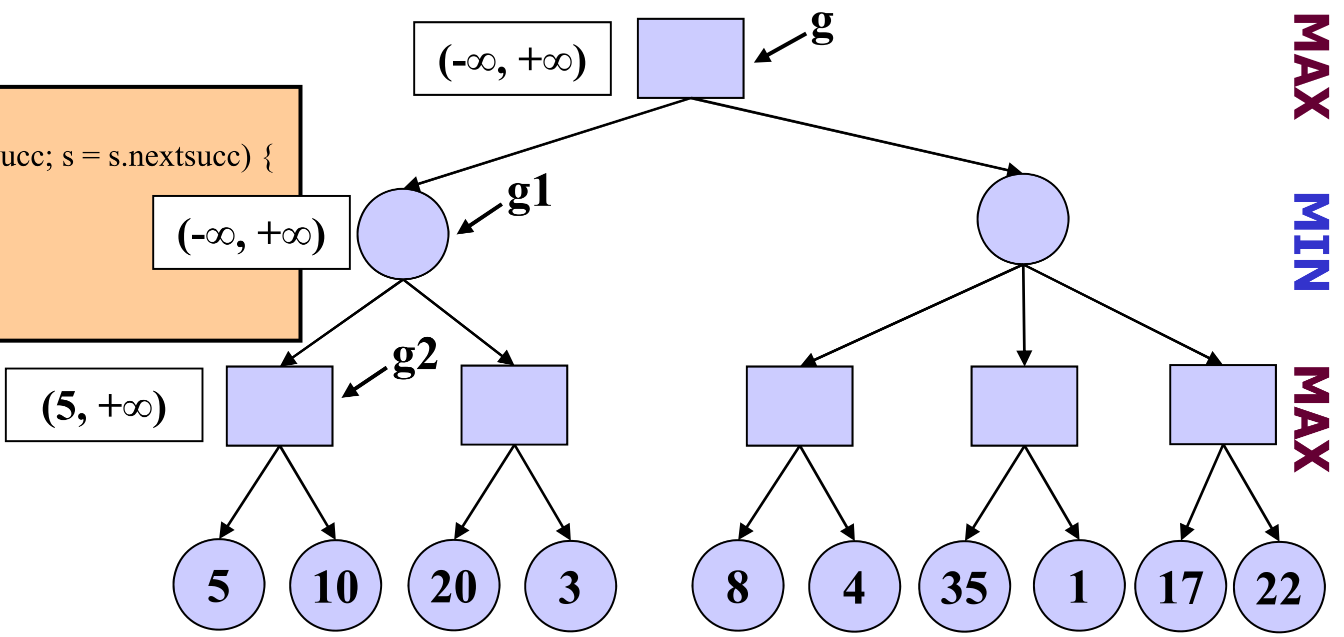
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 5;
        if ( α  ≥ +∞ ) break;
}
return α;
```



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

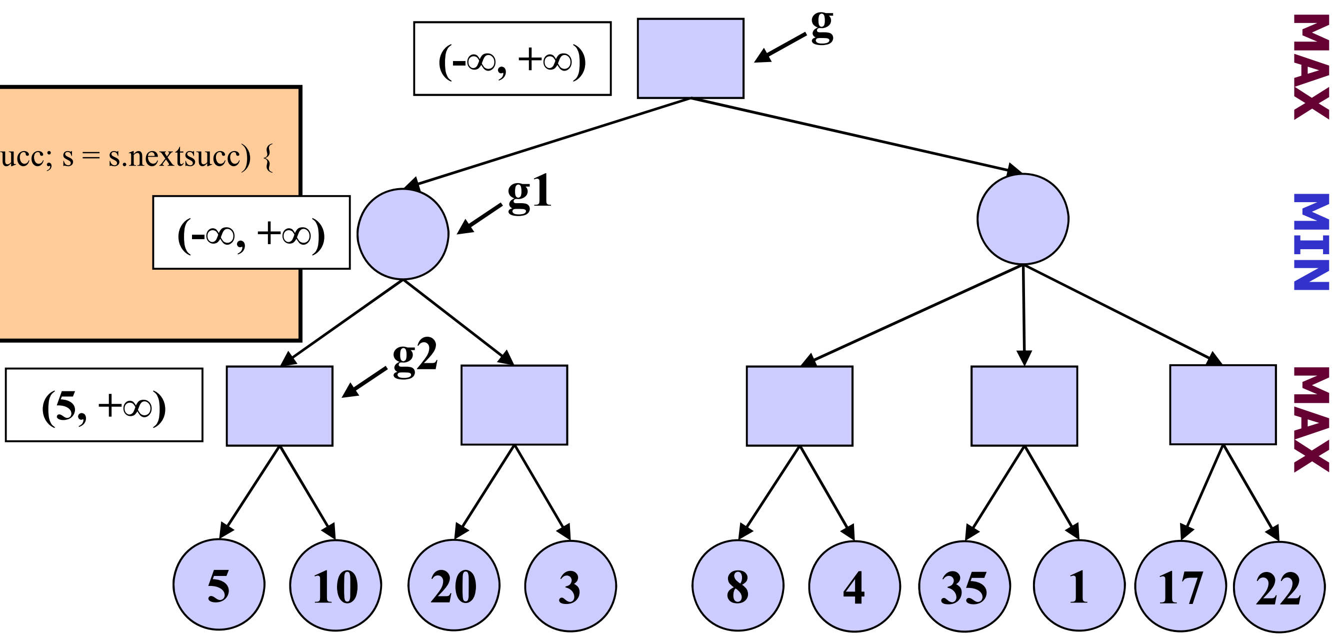
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 5;
        if ( α  ≥ +∞ ) break;
}
return α;
```

false!



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

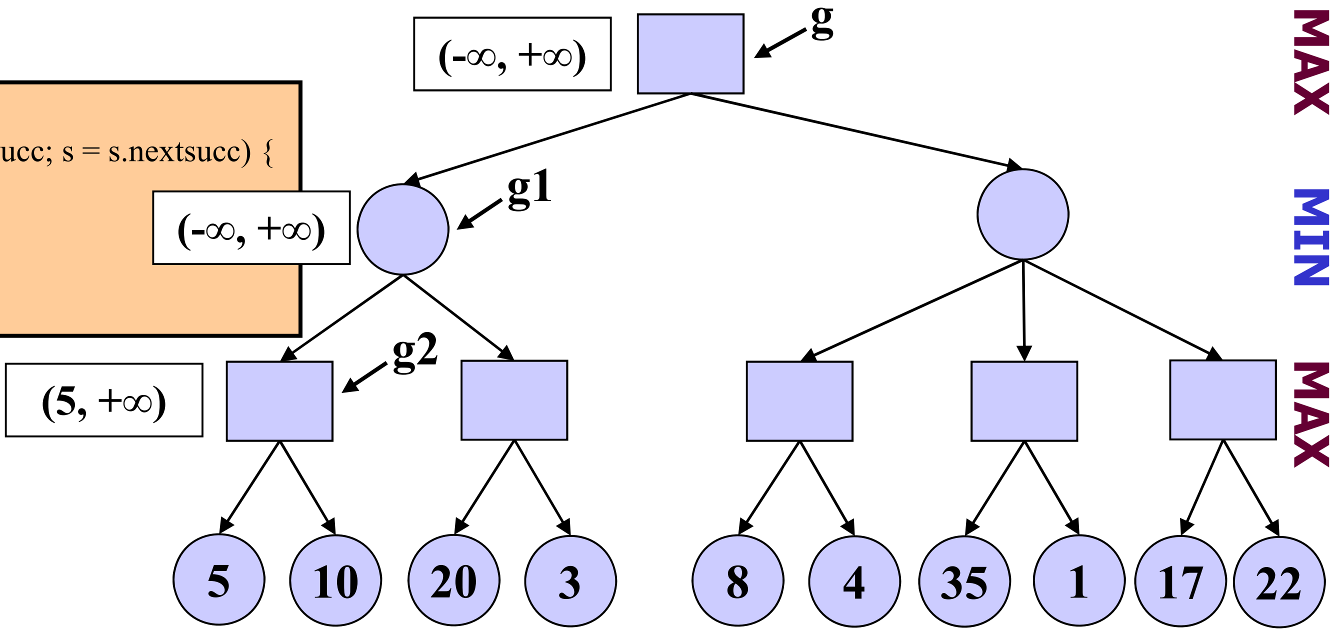
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

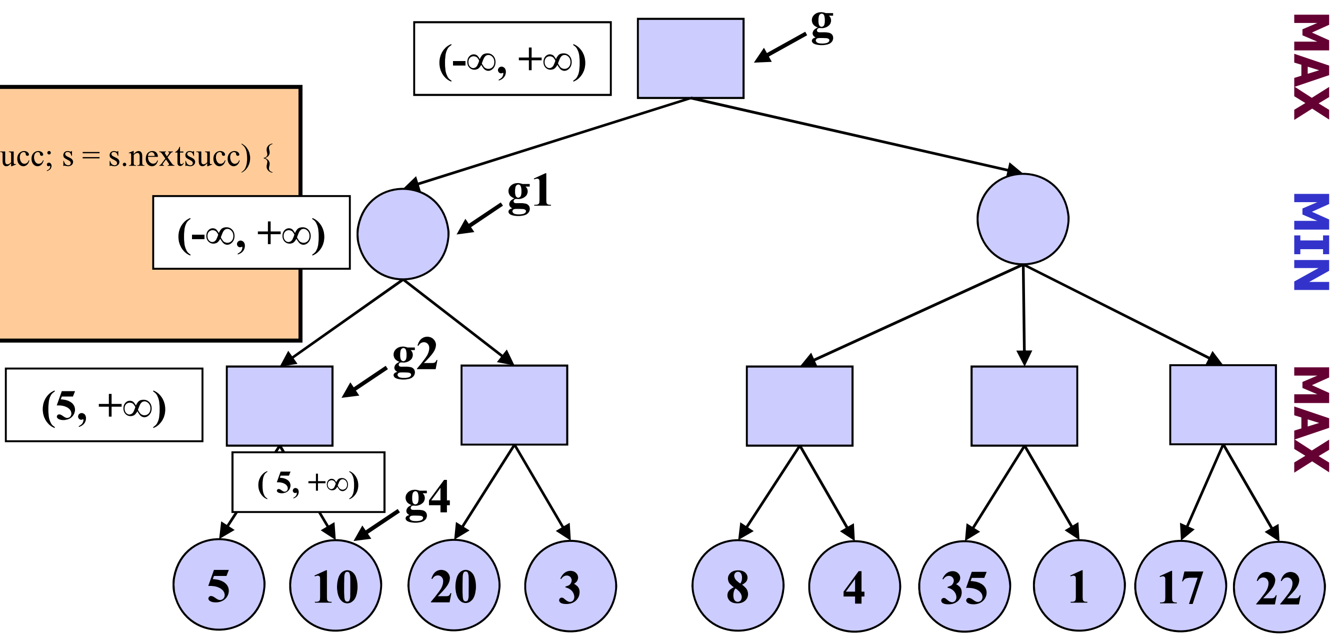
```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( 5 , minValue(s, 5 , +∞) );
        if ( α  ≥ +∞ ) break;
}
return α;
```

next successor



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



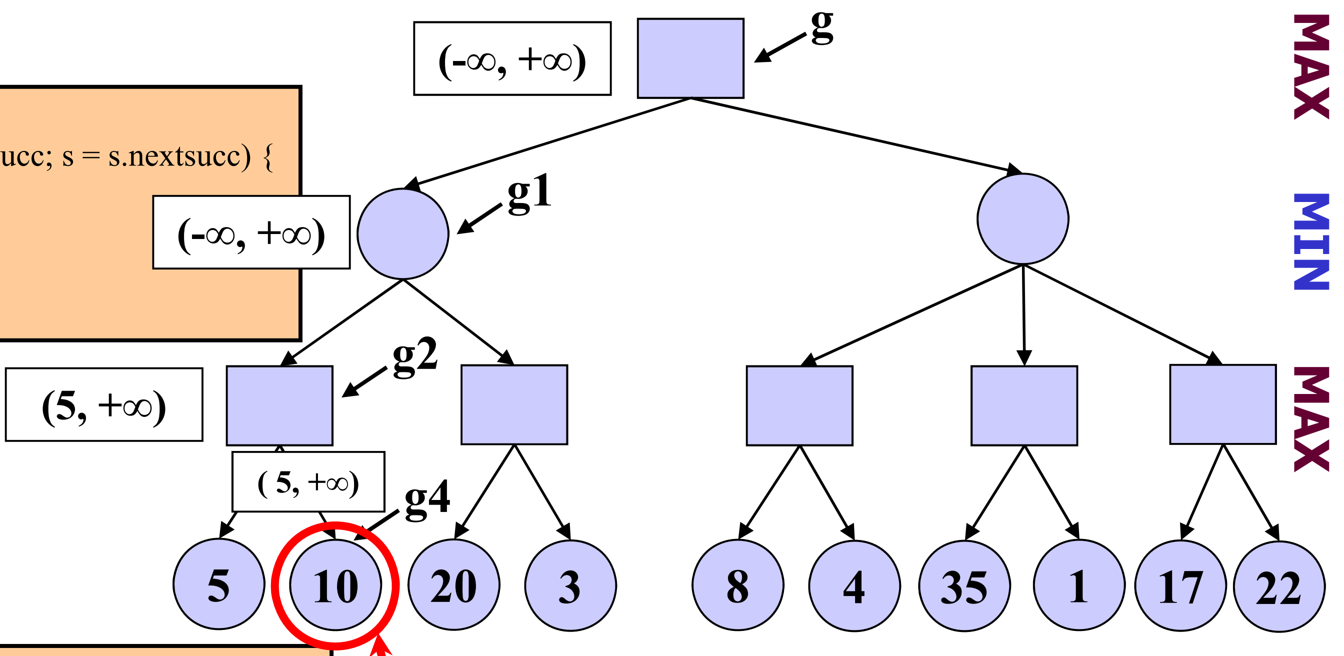
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( 5 , minValue(s, 5 , +∞) );
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g4, 5 , +∞)



```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

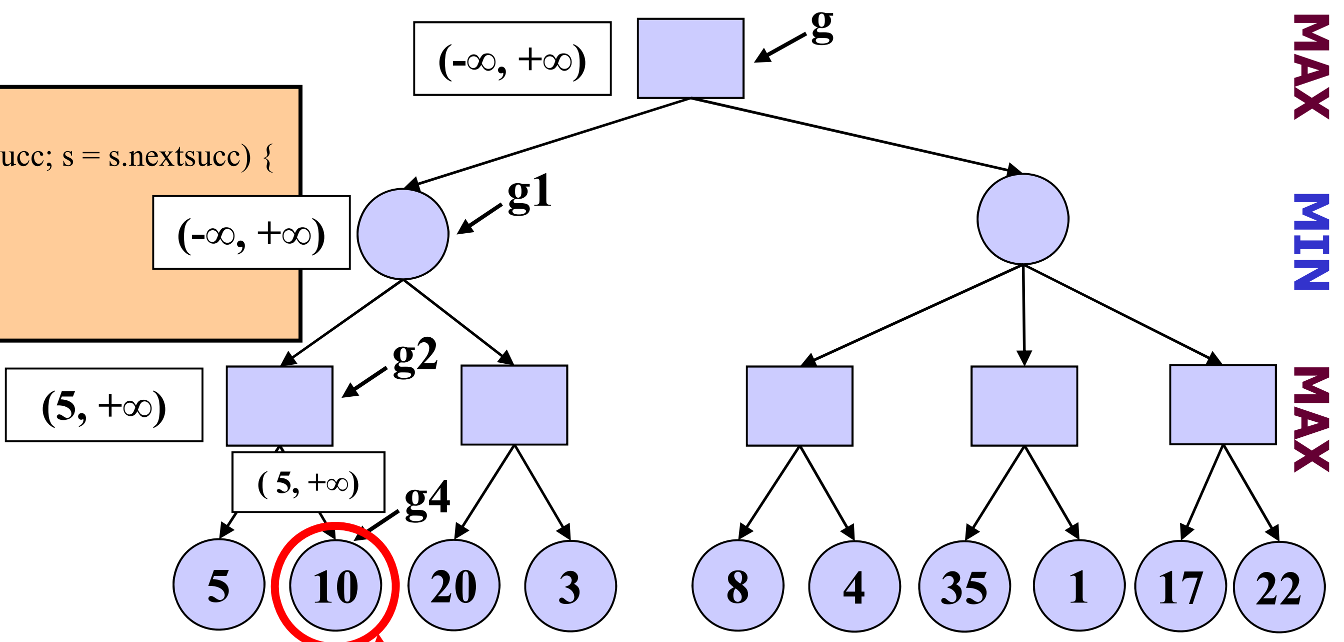
```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

```
maxValue(g2,-∞, +∞)
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( 5 , minValue(s, 5 , +∞) );
        if ( α  ≥ +∞ ) break;
}
return α;
```

```
minValue(g4, 5 , +∞)
cutofftest(g4)) → true!!
```

maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( 5 , minValue(s, 5 , +∞) );
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g4, 5 , +∞)

```
cutofftest(g4)) → true!!
⇒ eval(g4) = 10
⇒ return 10
```

maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

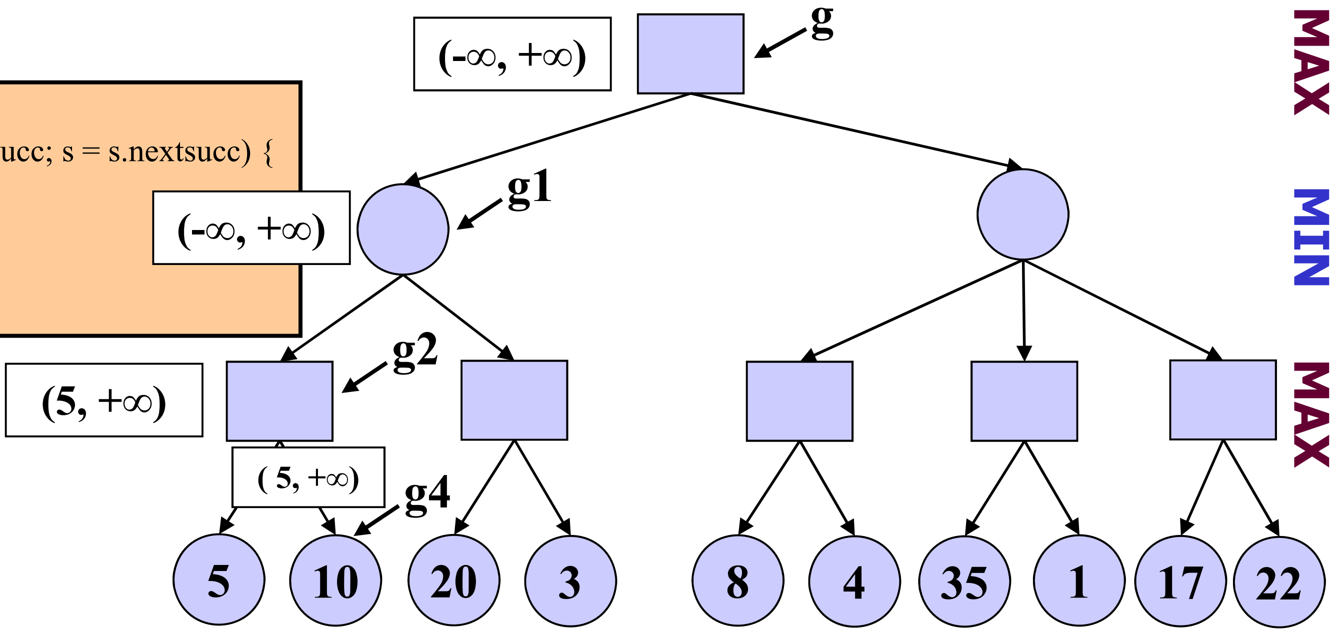
```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( 5 , minValue(s, 5 , +∞) );
        if ( α  ≥ +∞ ) break;
}
return α;
```

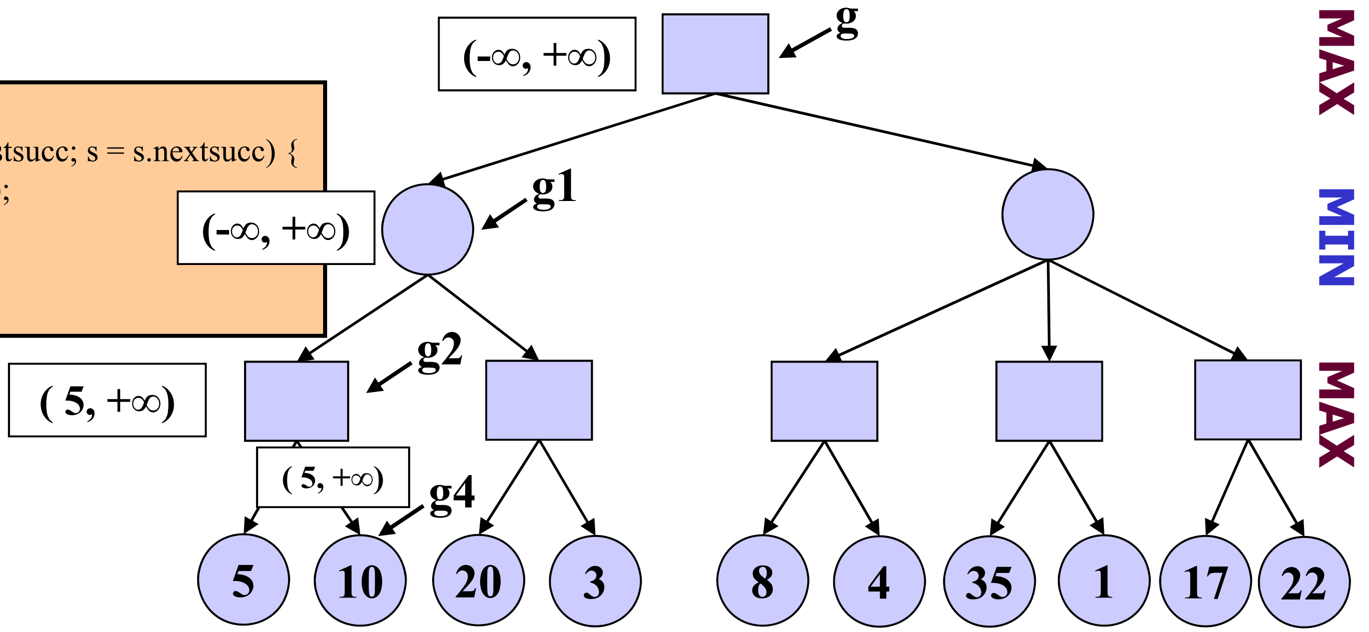
minValue(g4, 5 , +∞)

```
cutofftest(g4)) → true!!
⇒ eval(g4) = 10
⇒ return 10
```



Übungsbeispiel α-β-Algorithmus

```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

```
maxValue(g2,-∞, +∞)
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = max( 5 , 10 );
        if ( α  ≥ +∞ ) break;
}
return α;
```

```
minValue(g4, 5 , +∞)
cutofftest(g4)) → true!!
⇒ eval(g4) = 10
⇒ return 10
```

Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞, + ∞)

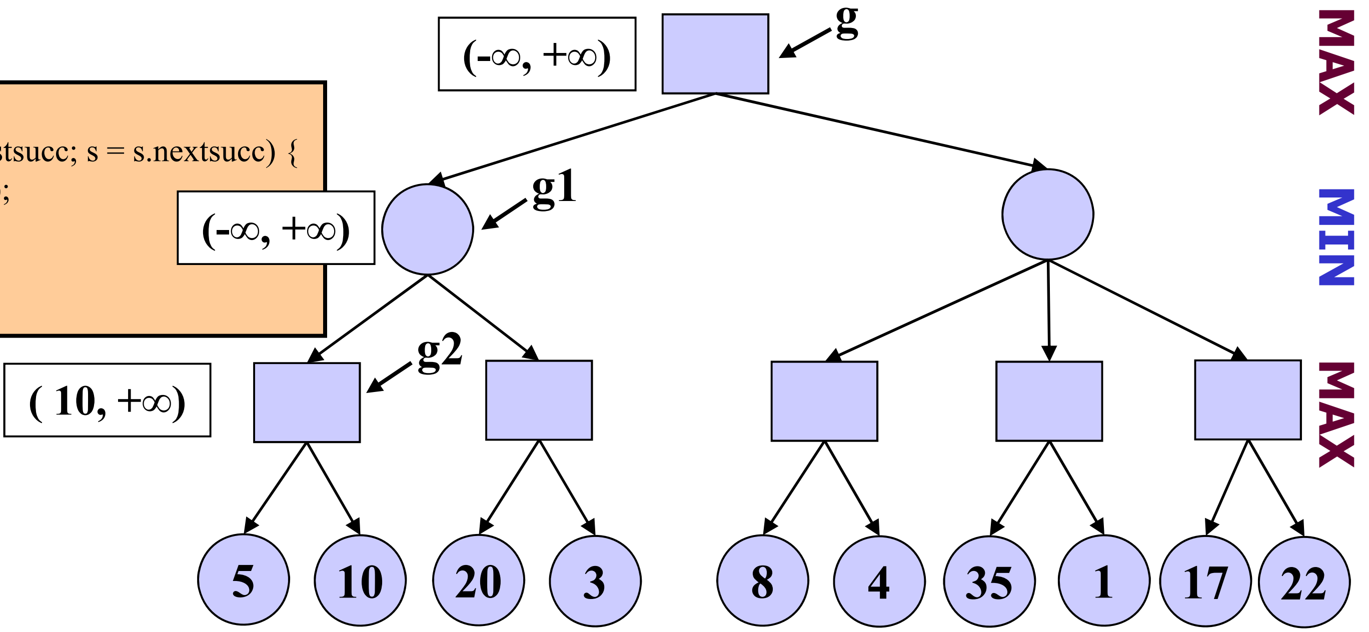
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( α  ≥ +∞ ) break;
}
return α;
```



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```

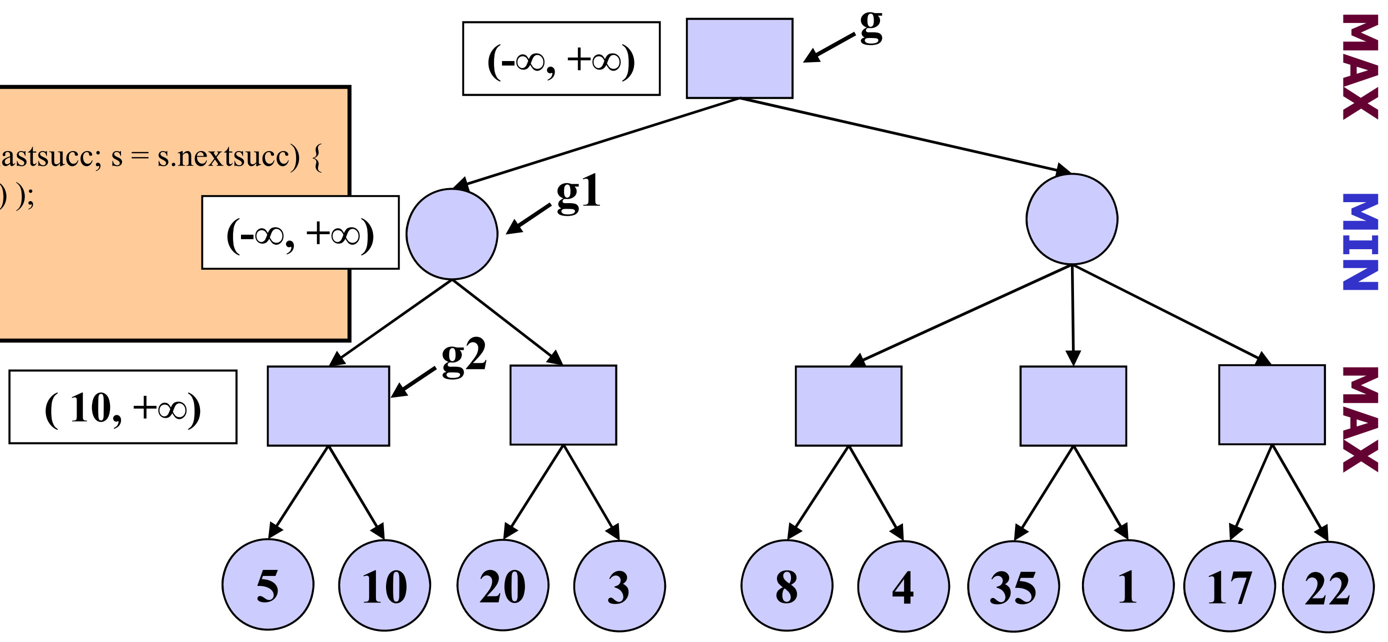
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( 10 ≥ +∞ ) break;
}
return α;
```

false!



Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

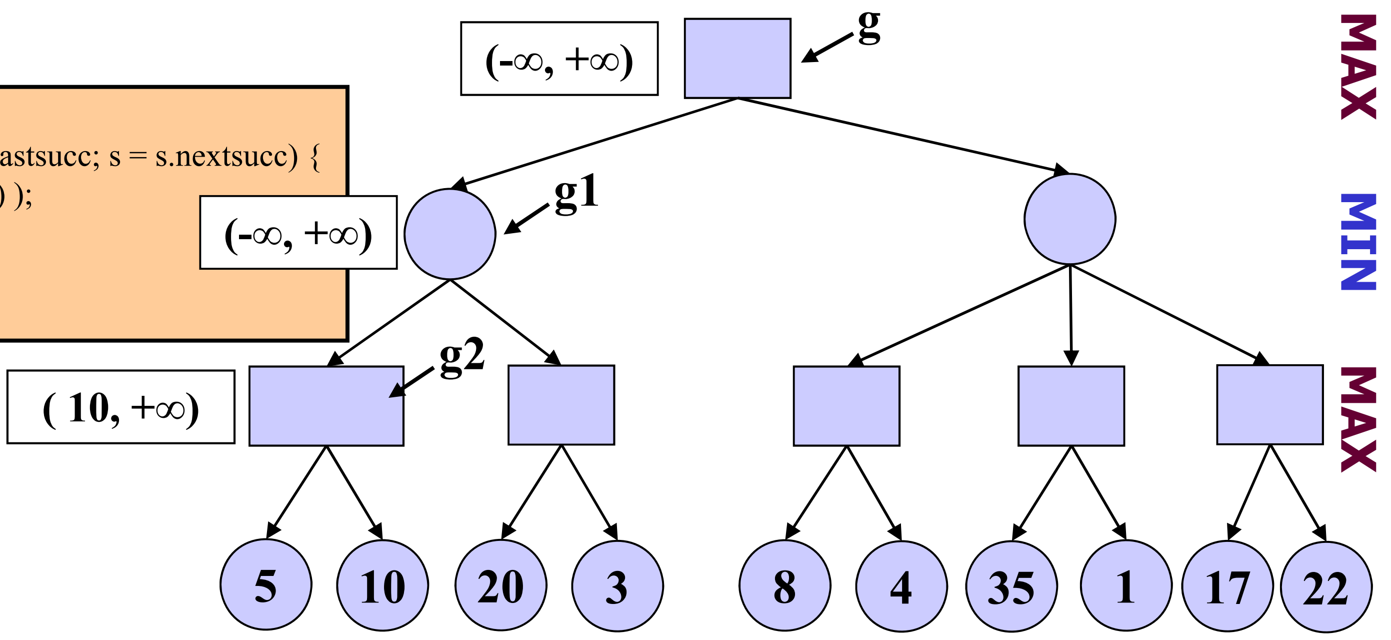
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( 10  ≥ +∞ ) break;
}
return α;
```

g2 has no more successors!



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

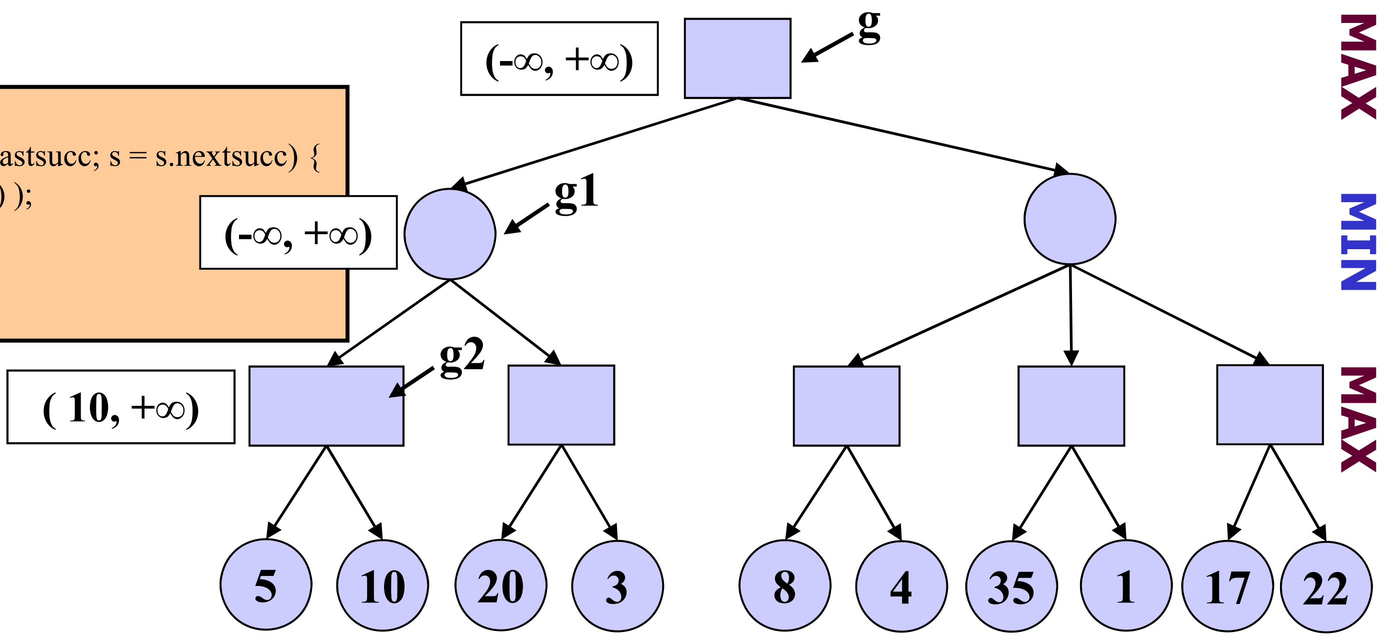
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( 10  ≥ +∞ ) break;
}
return α;
```

g2 has no more successors!



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

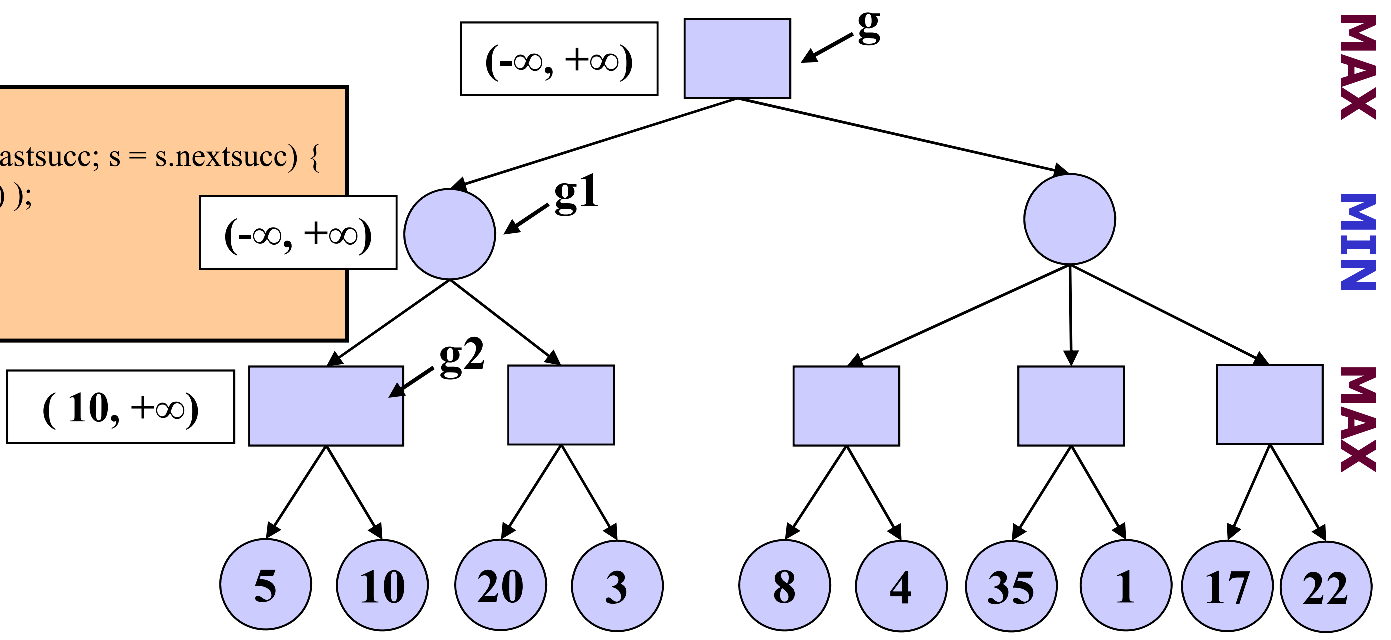
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, -∞, +∞) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

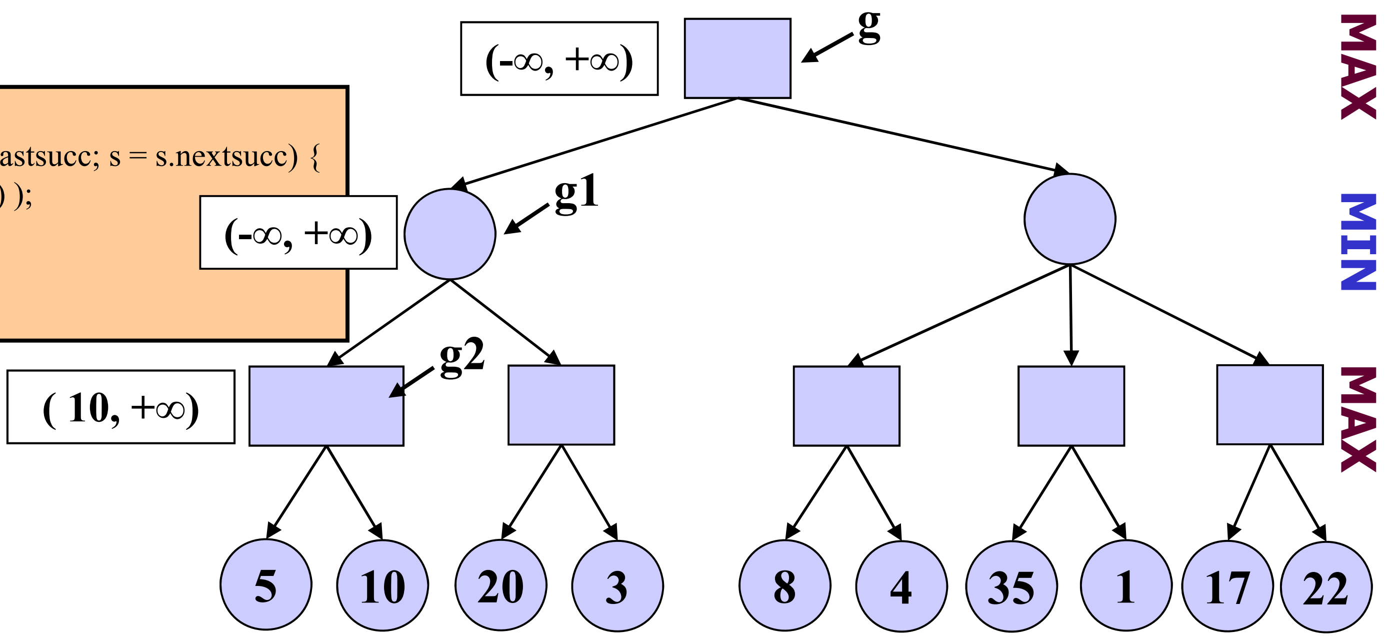
```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( 10  ≥ +∞ ) break;
}
return 10;
```

g2 has no more successors!



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
      α = max(-∞ , minValue(s, -∞, +∞) );
      if ( α ≥ +∞) break;
}
return α;
```



minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
      β = min(+∞ , maxValue(s, -∞, +∞) );
      if ( β ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
      α = 10;
      if ( 10 ≥ +∞ ) break;
}
return 10;
```

g2 has no more successors!

maxValue(g, - ∞, + ∞)

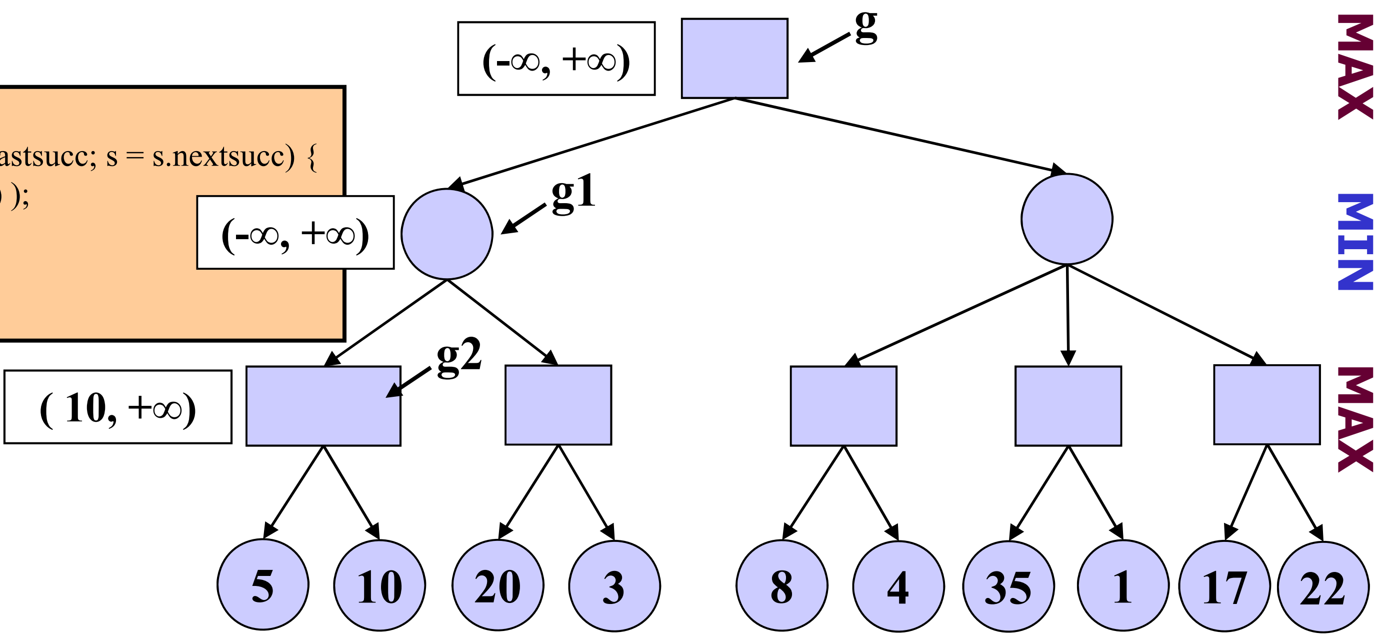
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
      α = max(-∞ , minValue(s, -∞, +∞) );
      if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
      β = min(+∞ , 10 );
      if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g2,-∞, +∞)

```
cutofftest(g2) → false
for (GameState s = g2.firstsucc; s != g2.lastsucc; s = s.nextsucc) {
      α = 10;
      if ( 10  ≥ +∞ ) break;
}
return 10;
```

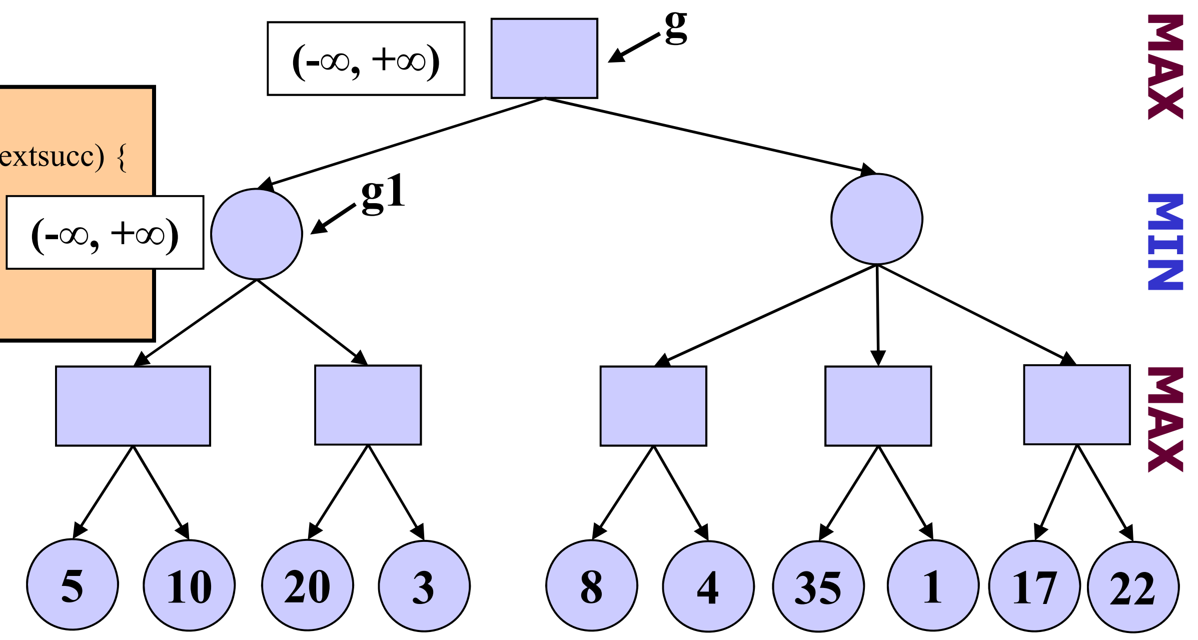


maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
    α = max(-∞ , minValue(s, -∞, +∞) );
    if ( α ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
    β = min(+∞ , 10 );
    if ( β ≤ -∞ ) break;
}
return β;
```

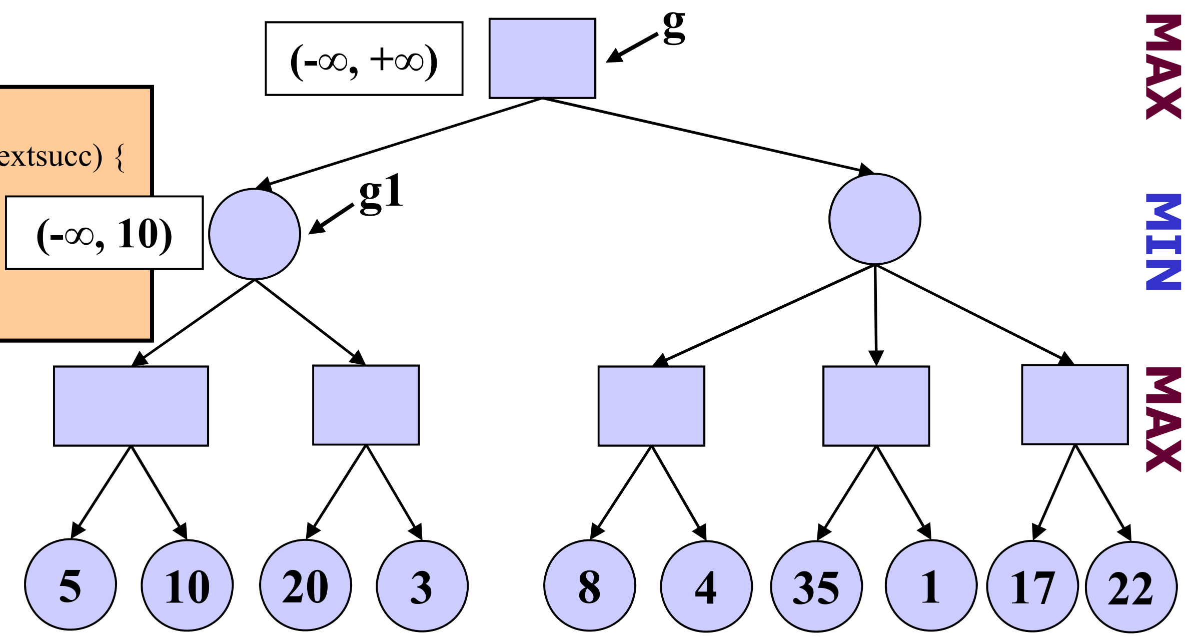


maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

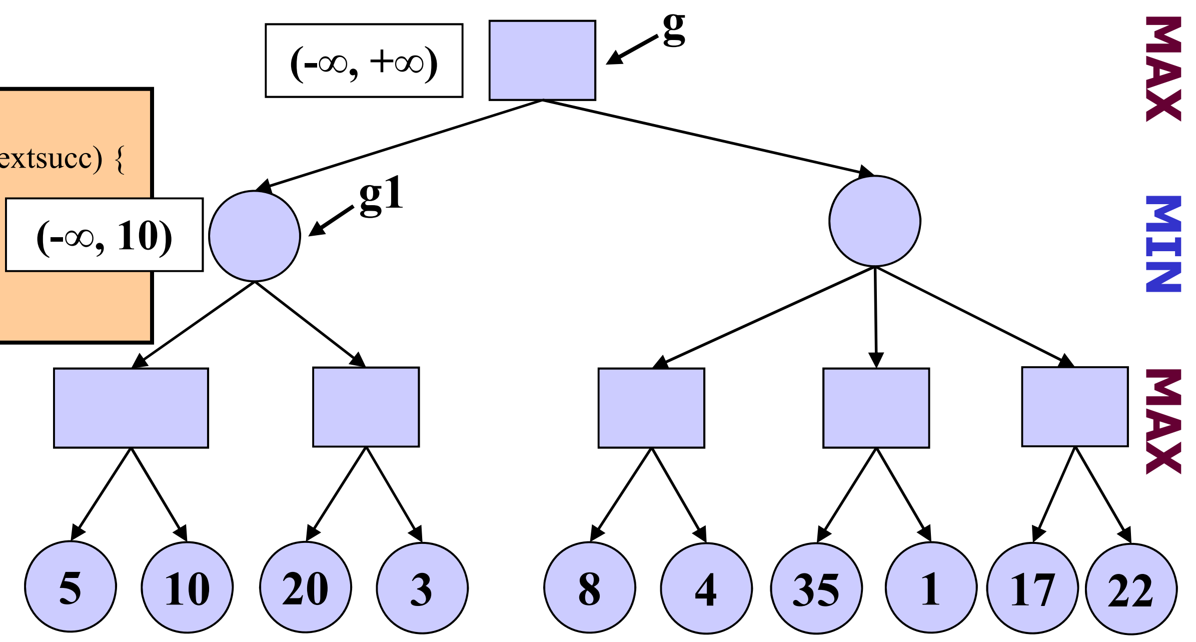
```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤ -∞ ) break;
}
return β;
```



```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤ -∞ ) break;
}
return β;
```

false!



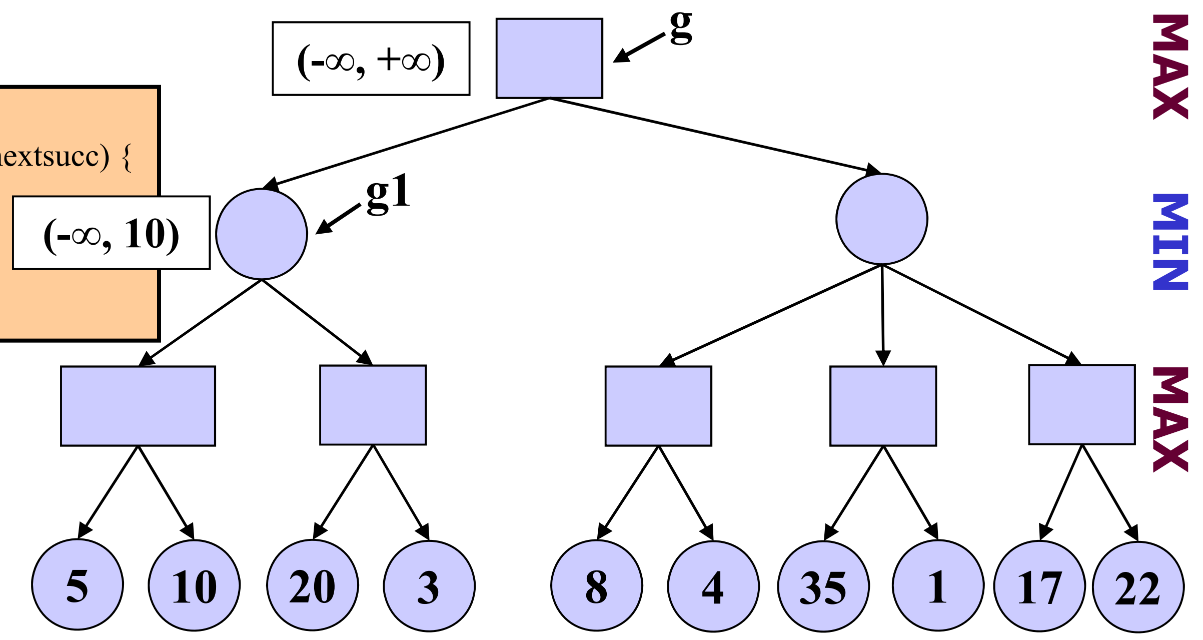
maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

next successor



maxValue(g, - ∞, + ∞)

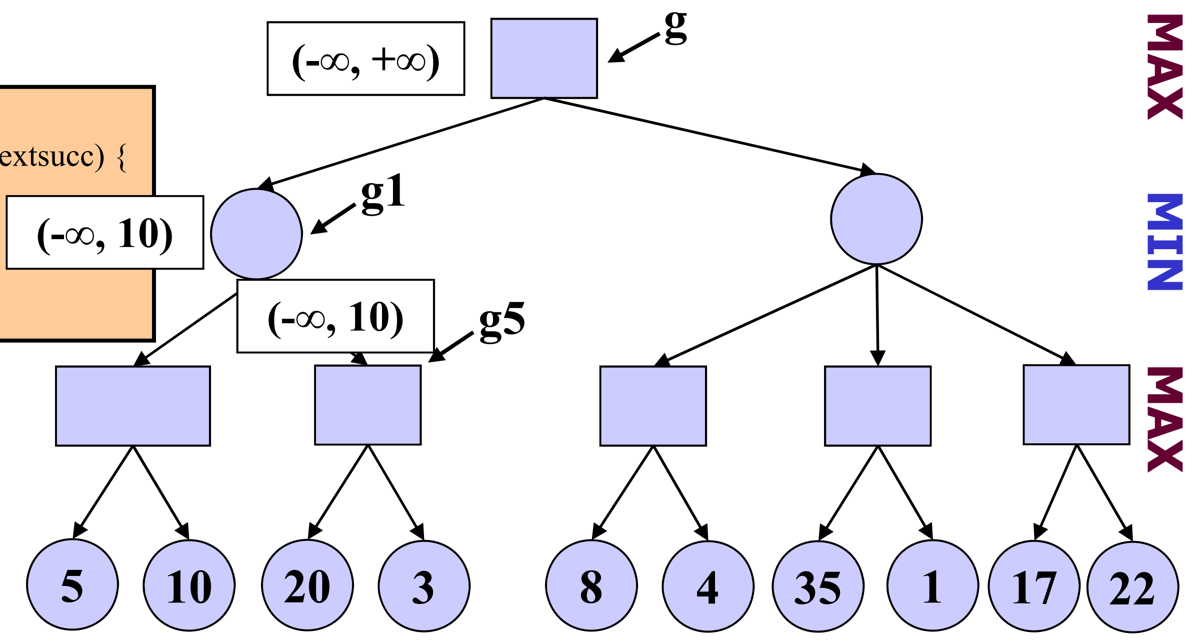
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g5, -∞, 10)

```
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞ , 10) );
        if ( α  ≥ 10 ) break;
}
return α;
```



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```

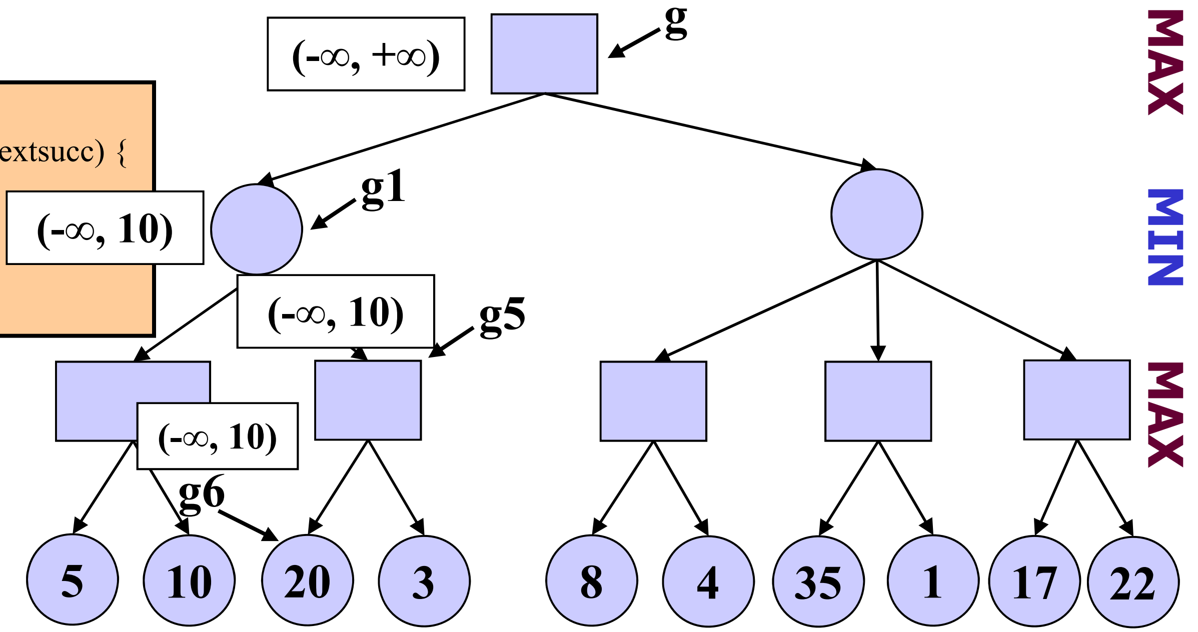
minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β ≤ -∞ ) break;
}
return β;
```

maxValue(g5, -∞, 10)

```
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞ , 10) );
        if ( α ≥ 10 ) break;
}
return α;
```

minValue(g6, -∞, 10)



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

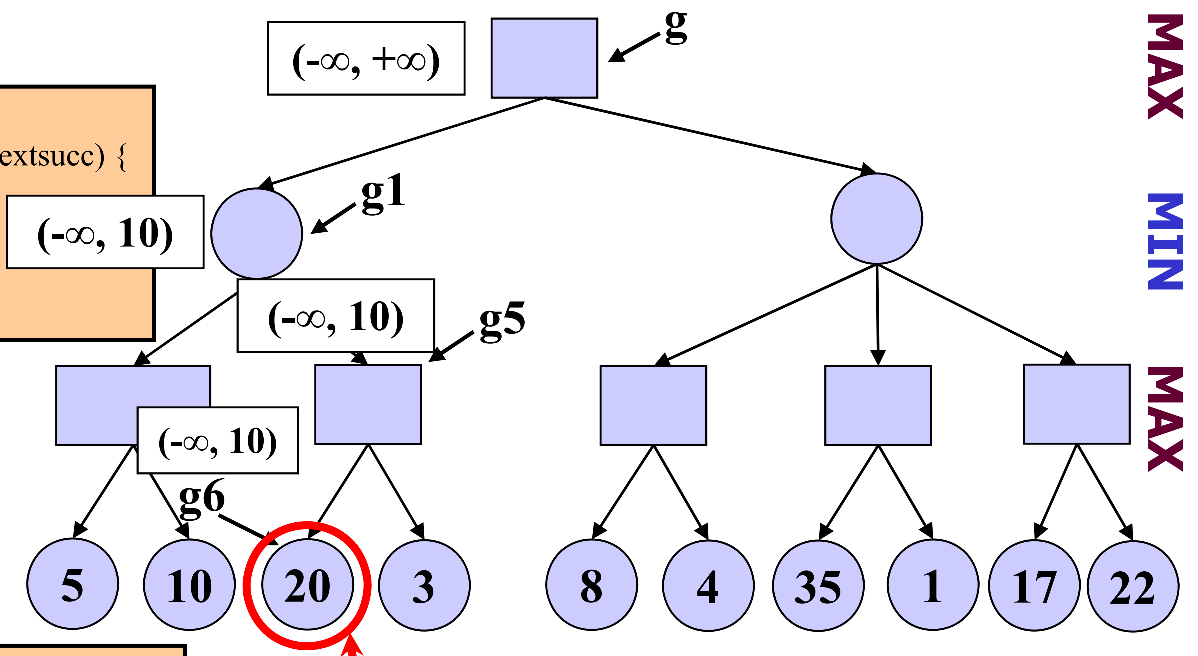
```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β ≤ -∞ ) break;
}
return β;
```

maxValue(g5, -∞, 10)

```
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞ , 10) );
        if ( α ≥ 10 ) break;
}
return α;
```

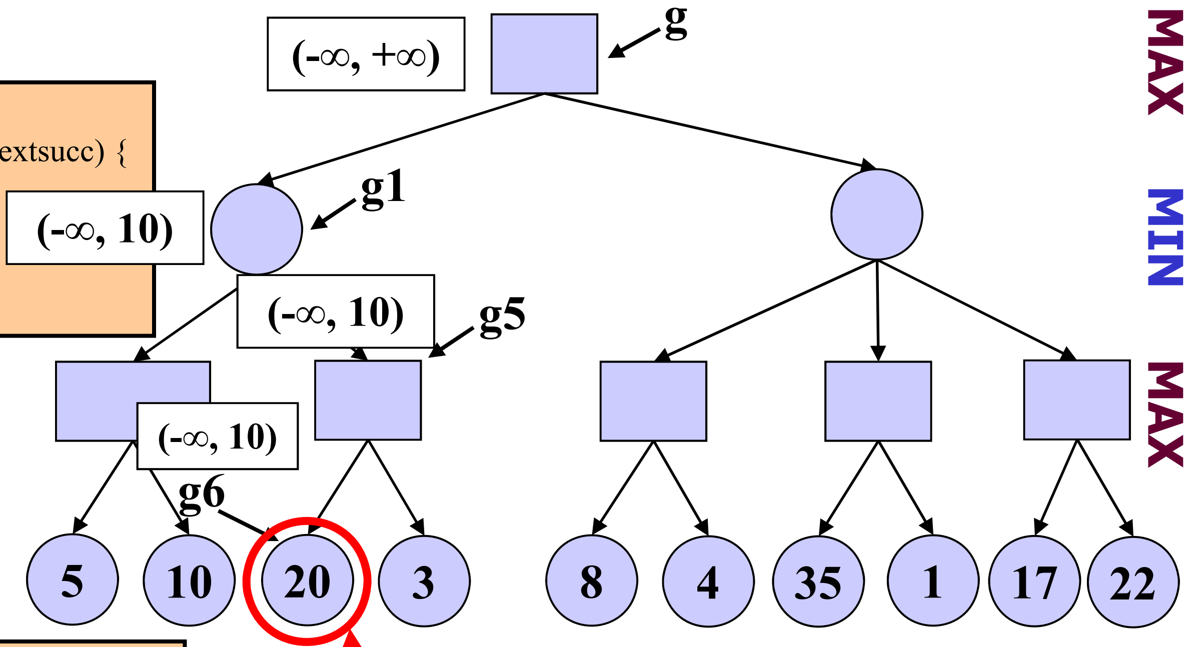
minValue(g6, -∞, 10)

```
cutofftest(g6)) → true!!
```



maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g5, -∞, 10)

```
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞ , 10) );
        if ( α  ≥ 10 ) break;
}
return α;
```

minValue(g6, -∞, 10)

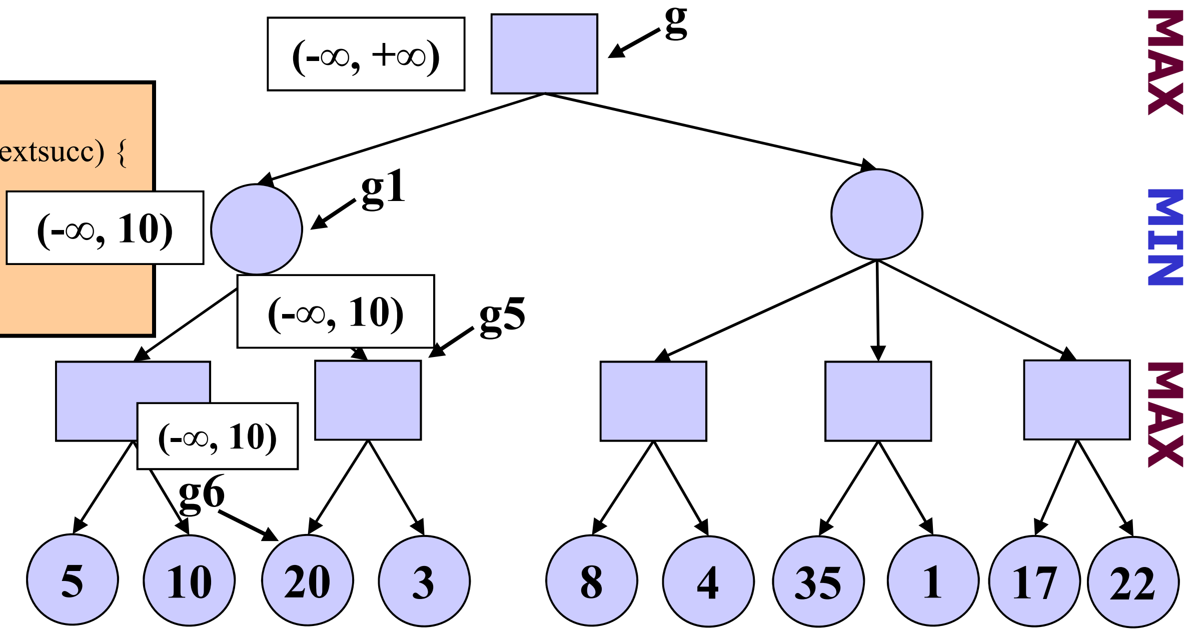
```
cutofftest(g6)) → true!!
⇒ eval(g6) = 20
⇒ return 20
```

```
maxValue(g, - ∞, + ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)

cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

```
maxValue(g5, -∞, 10)

cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = max(-∞, minValue(s, -∞ , 10) );
        if ( α  ≥ 10 ) break;
}
return α;
```

```
minValue(g6, -∞, 10)

cutofftest(g6)) → true!!
⇒ eval(g6) = 20
⇒ return 20
```

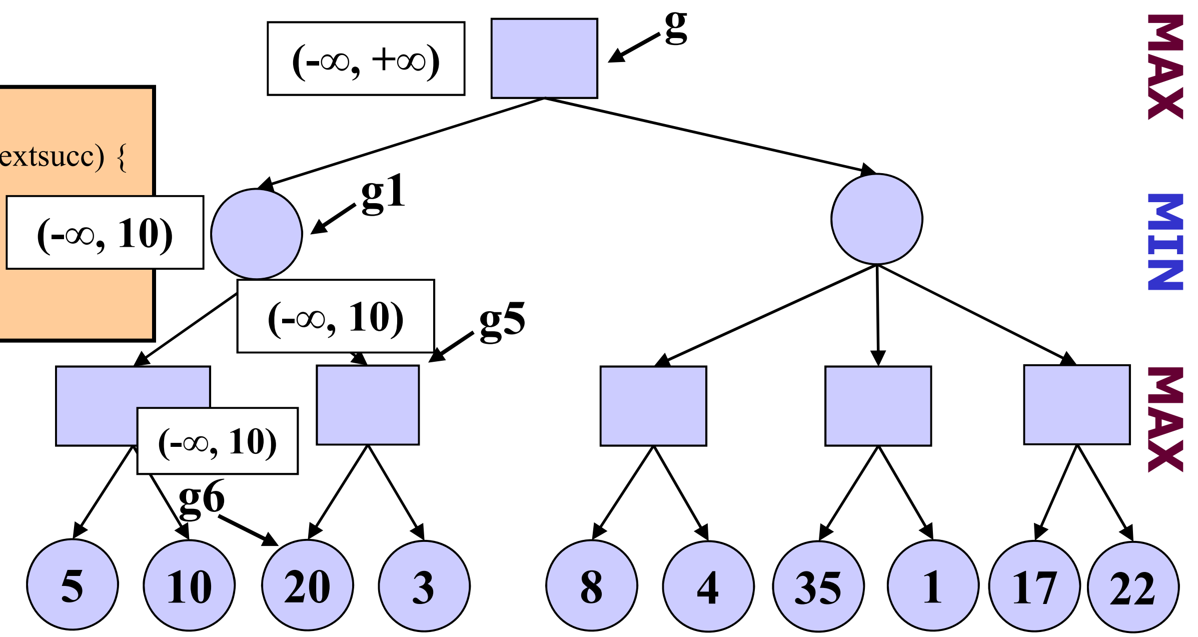


```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

```
maxValue(g5, -∞, 10)
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = max(-∞ , 20 );
        if ( α  ≥ 10 ) break;
}
return α;
```

```
minValue(g6, -∞, 10)
cutofftest(g6)) → true!!
⇒ eval(g6) = 20
⇒ return 20
```



maxValue(g, - ∞, + ∞)

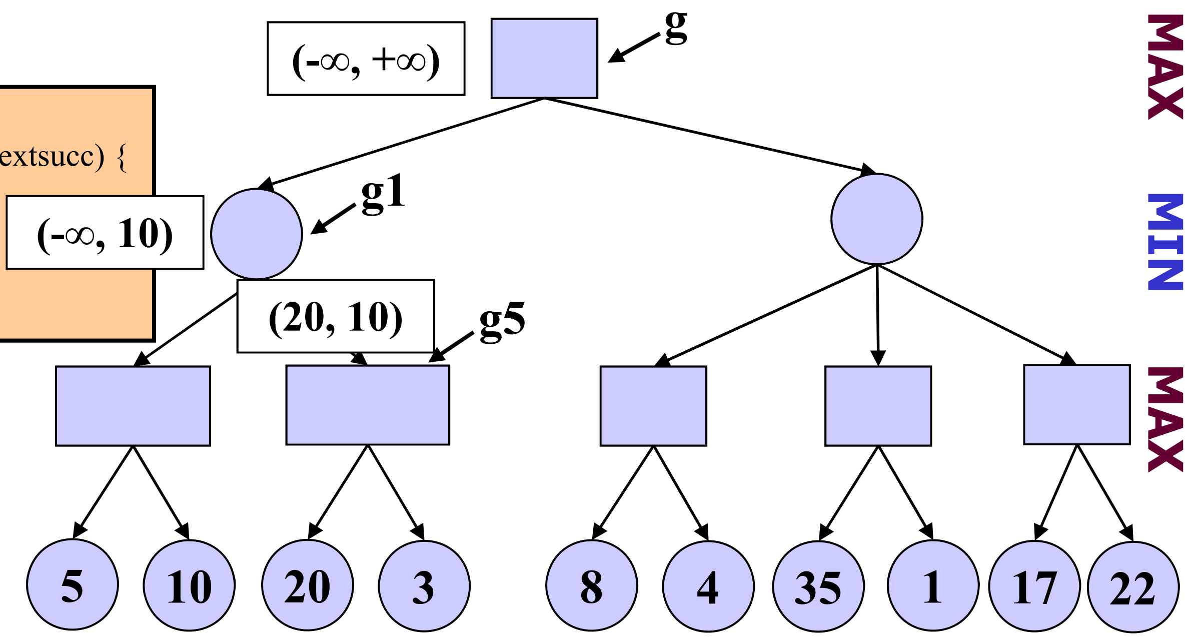
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
    α = max(-∞ , minValue(s, -∞, +∞) );
    if ( α ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
    β = min(10 , maxValue(s, -∞, 10) );
    if ( β ≤ -∞ ) break;
}
return β;
```

maxValue(g5, -∞, 10)

```
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
    α = 20;
    if ( α ≥ 10 ) break;
}
return α;
```



maxValue(g, - ∞, + ∞)

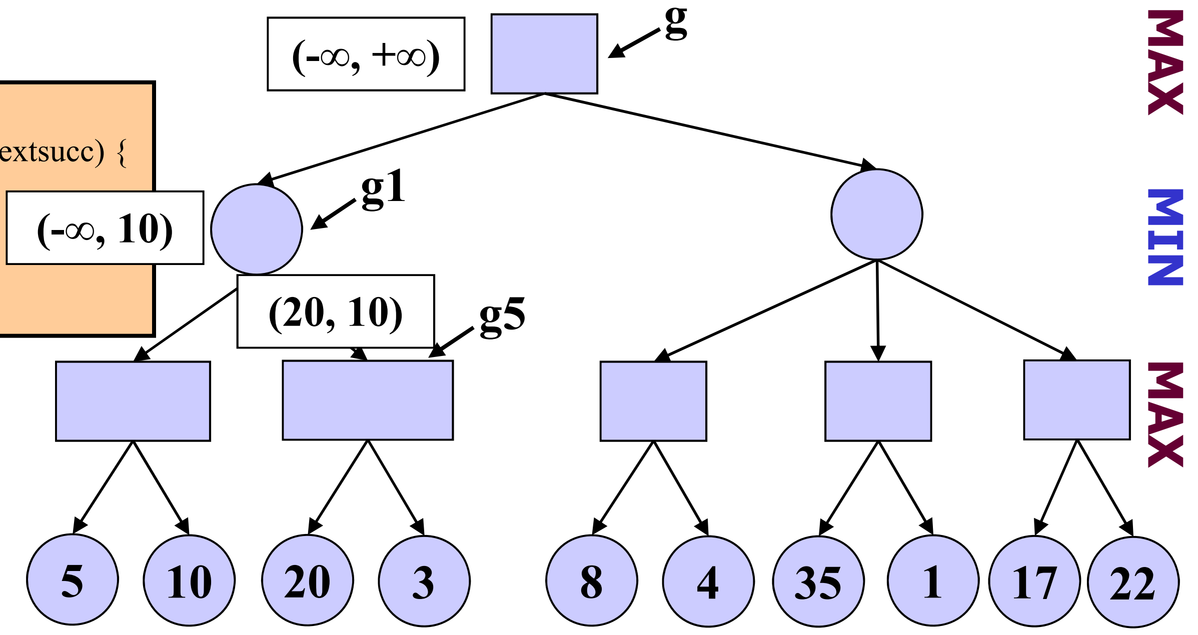
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

maxValue(g5, -∞, 10)

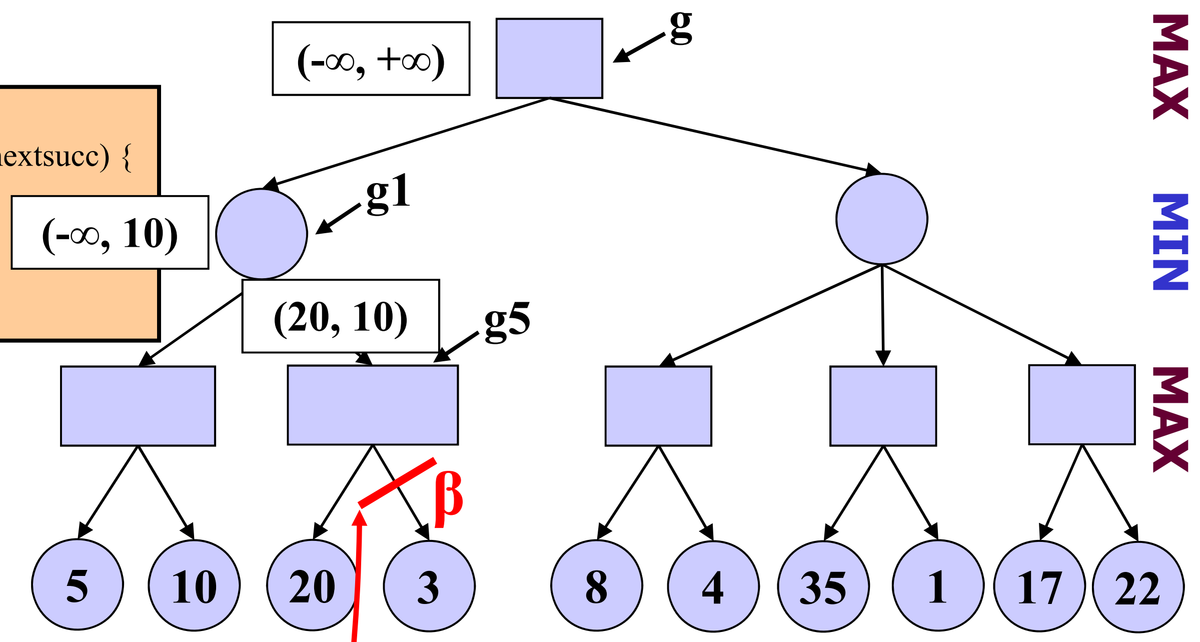
```
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = 20 ;
        if ( 20  ≥ 10 ) break;
}
return α;          true!
```



```
maxValue(g, - ∞, + ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)

cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

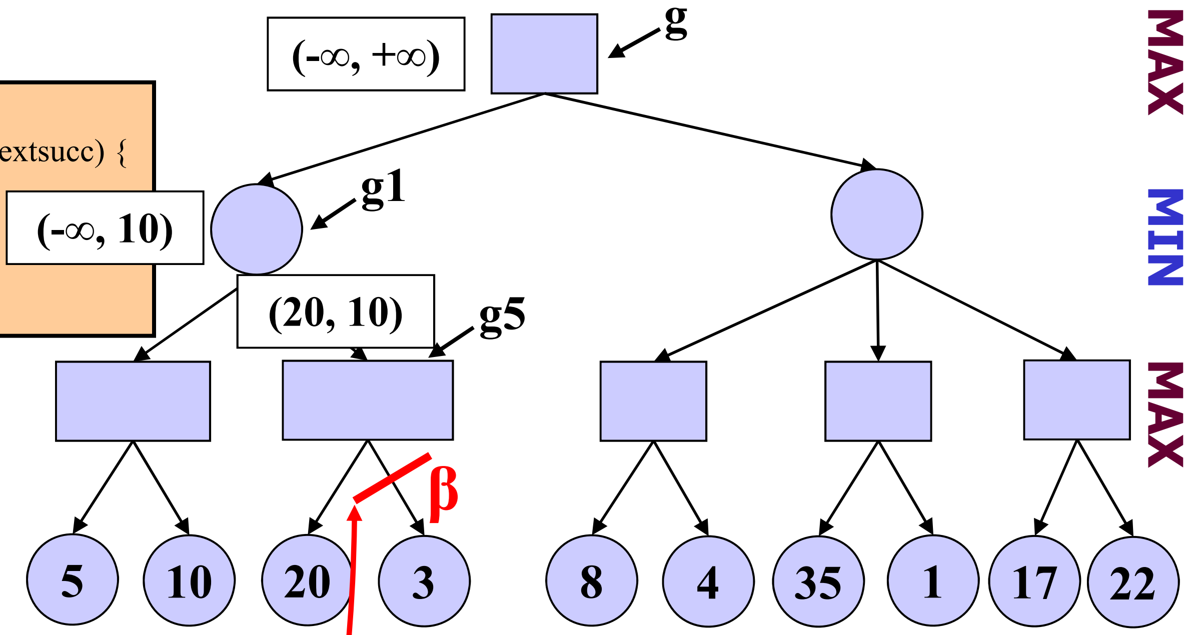
```
maxValue(g5, -∞, 10)

cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = 20 ;
        if ( 20  ≥ 10 ) break; // β Schnitt!!
}
return 20;
```



```
maxValue(g, - ∞, + ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)

cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , maxValue(s, -∞, 10) );
        if ( β  ≤ -∞ ) break;
}
return β;
```

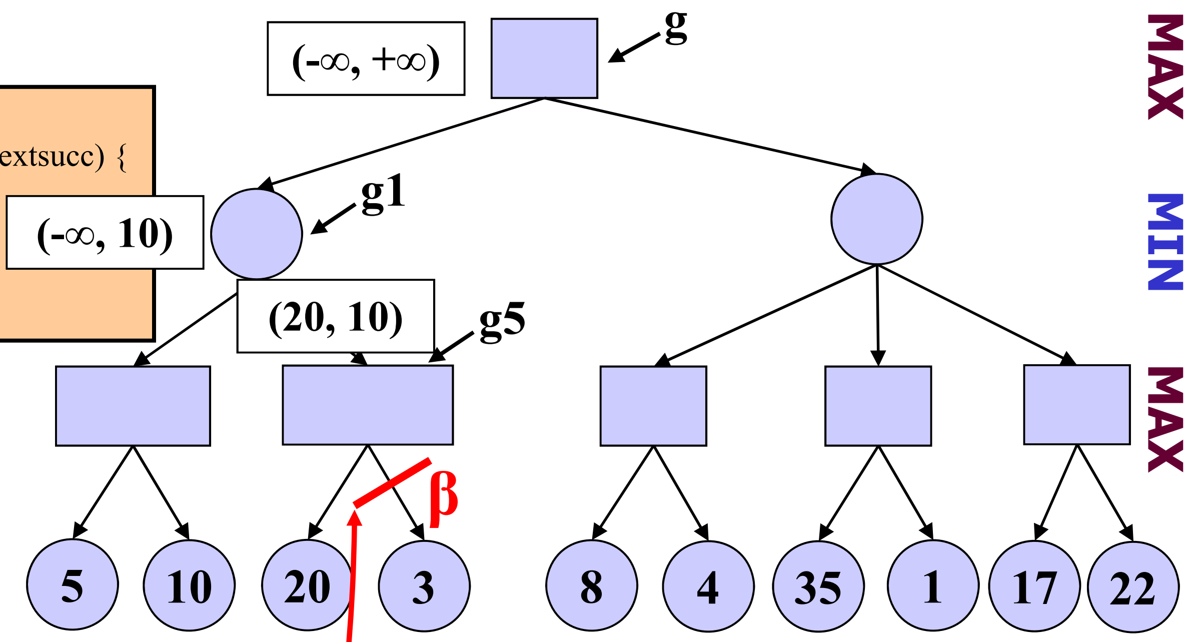
```
maxValue(g5, -∞, 10)

cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = 20 ;
        if ( 20  ≥ 10 ) break; // β Schnitt!!
}
return 20;
```



```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(10 , 20 );
        if ( β  ≤ - ∞ ) break;
}
return β;
```

```
maxValue(g5, -∞, 10)
cutofftest(g5) → false
for (GameState s = g5.firstsucc; s != g5.lastsucc; s = s.nextsucc) {
        α = 20 ;
        if ( 20  ≥ 10 ) break; // β Schnitt!!
}
return 20;
```



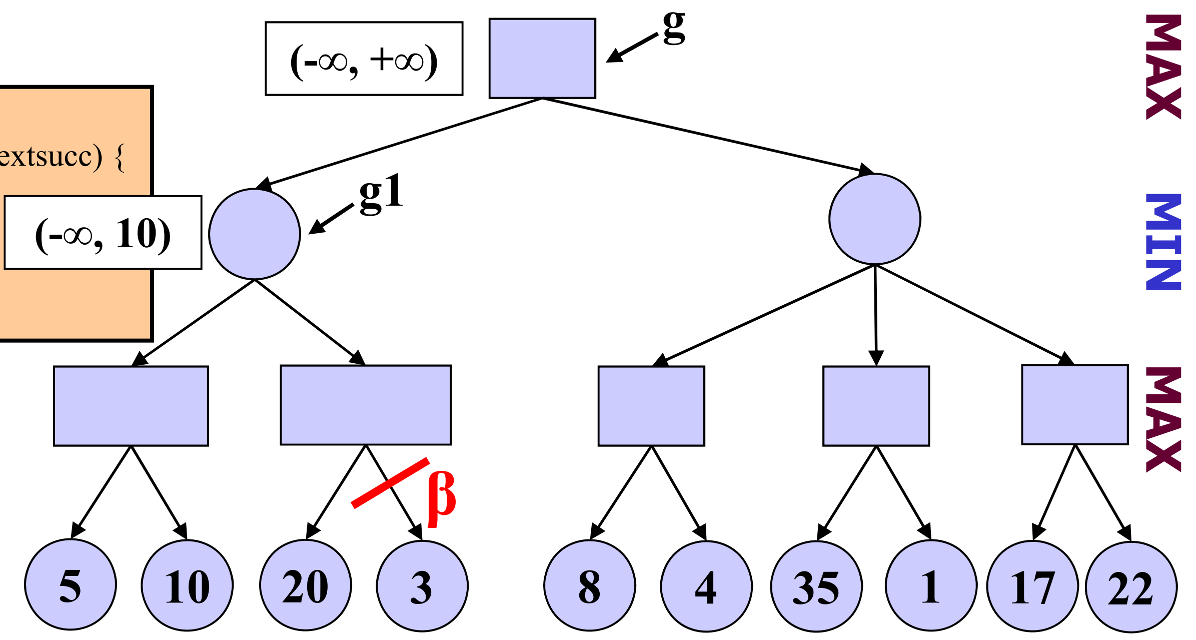
Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤ - ∞ ) break;
}
return β;
```



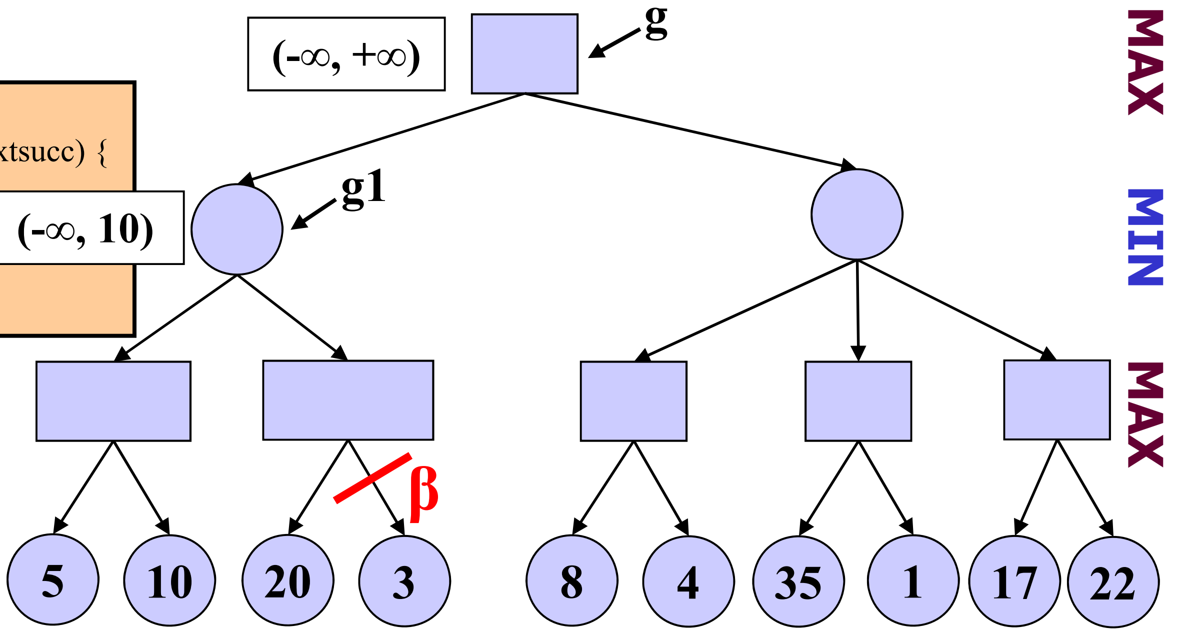
maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤ - ∞ ) break;
}
return β;
```

false!



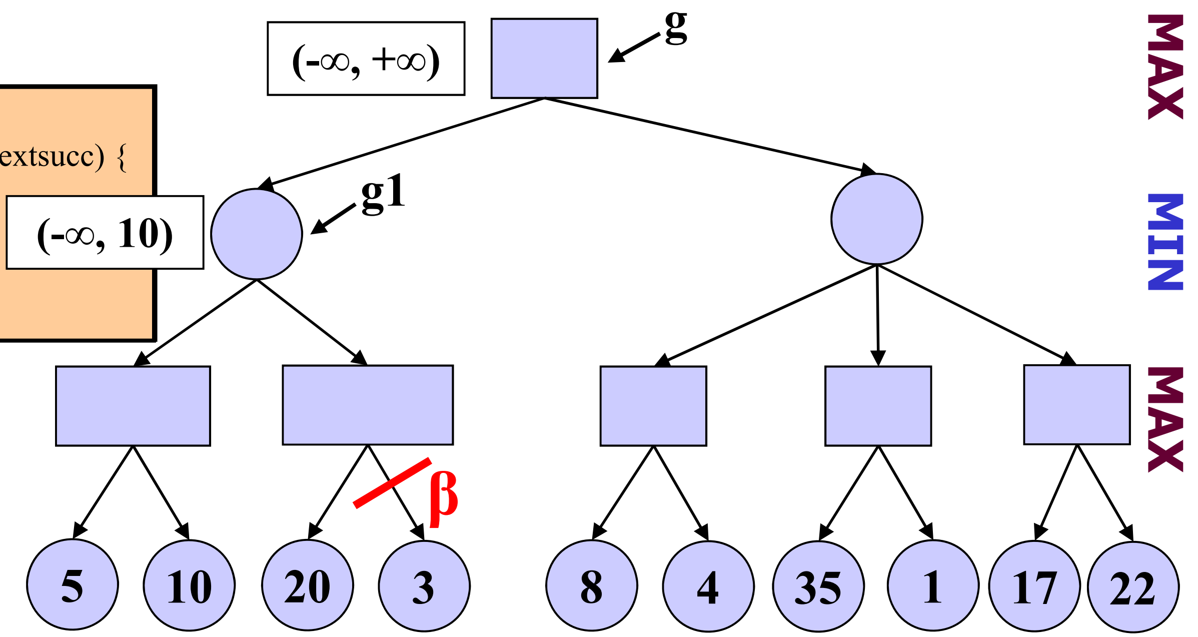
maxValue(g, - ∞, + ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , minValue(s, -∞, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g1, -∞, +∞)

```
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤ - ∞ ) break;
}
return β;
```

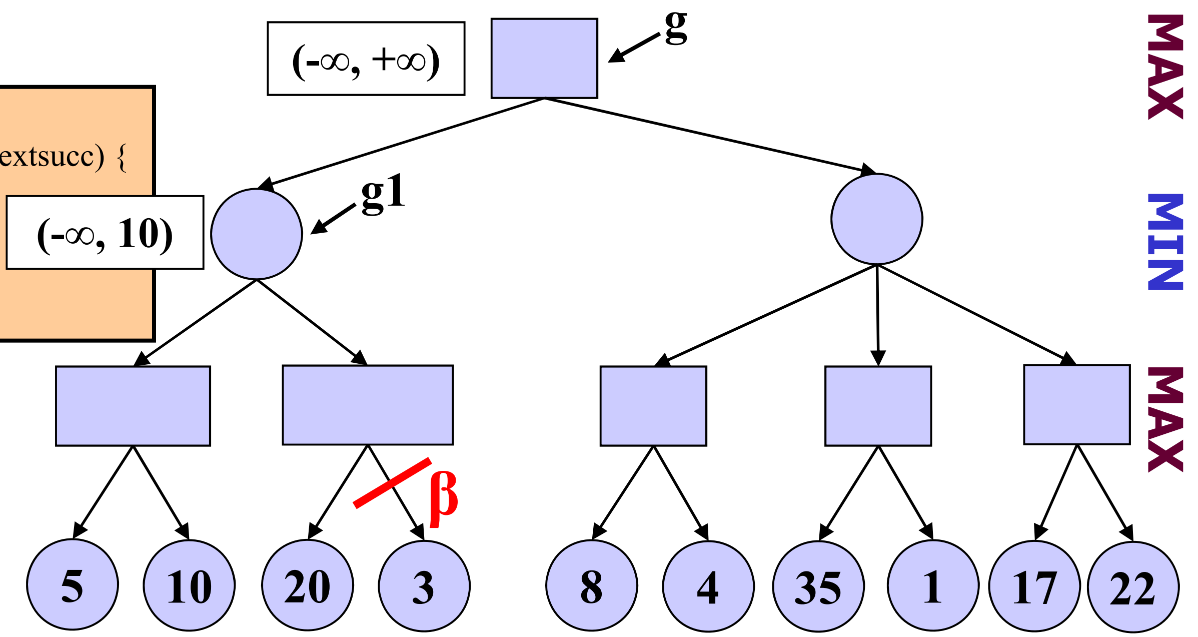
g1 has no more successors!



```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
      α = max(-∞ , minValue(s, -∞, +∞) );
      if ( α ≥ +∞) break;
}
return α;
```

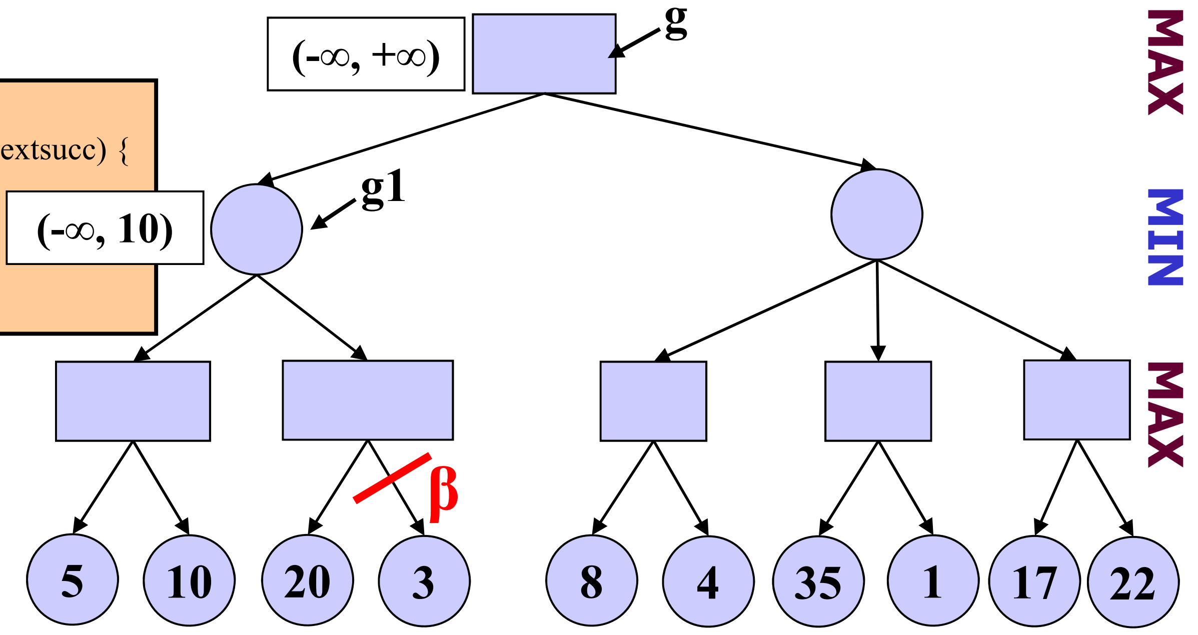
```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
      β = 10;
      if ( 10 ≤ - ∞ ) break;
}
return 10;
```

g1 has no more successors!



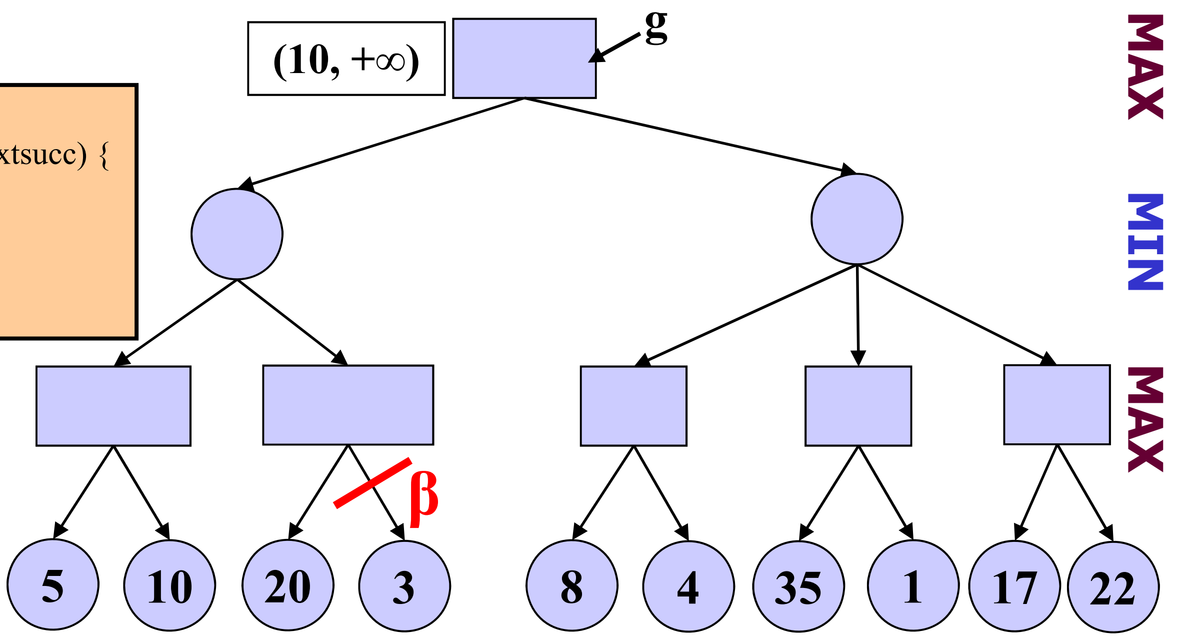
```
maxValue(g, - ∞, + ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(-∞ , 10 );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g1, -∞, +∞)
cutofftest(g1)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤ - ∞ ) break;
}
return 10;
```



Übungsbeispiel α-β-Algorithmus

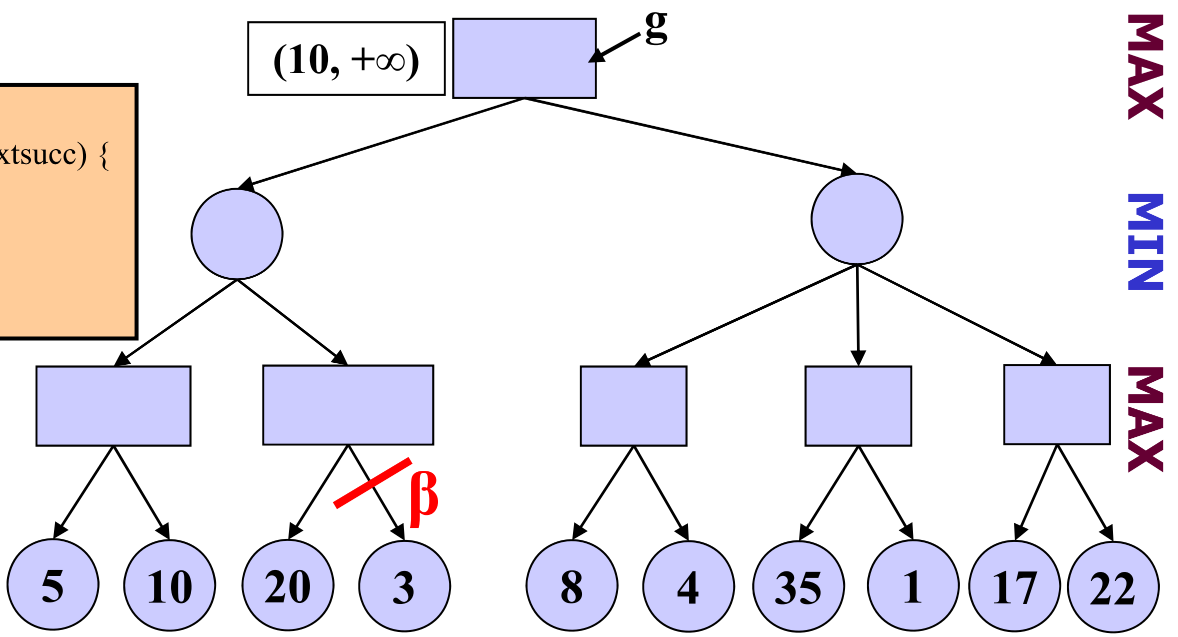
```
maxValue(g, - ∞, + ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
    α = 10;
    if ( α ≥ +∞) break;
}
return α;
```



maxValue(g, - ∞, + ∞)

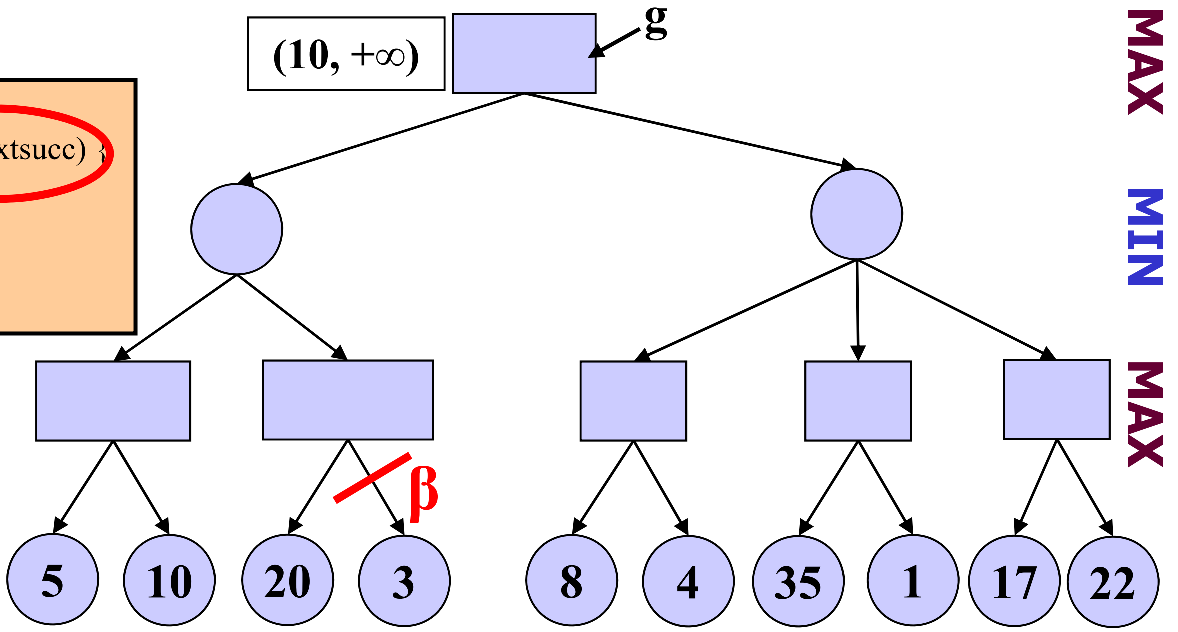
```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( 10 ≥ +∞) break;
}
return α;
```

false!



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

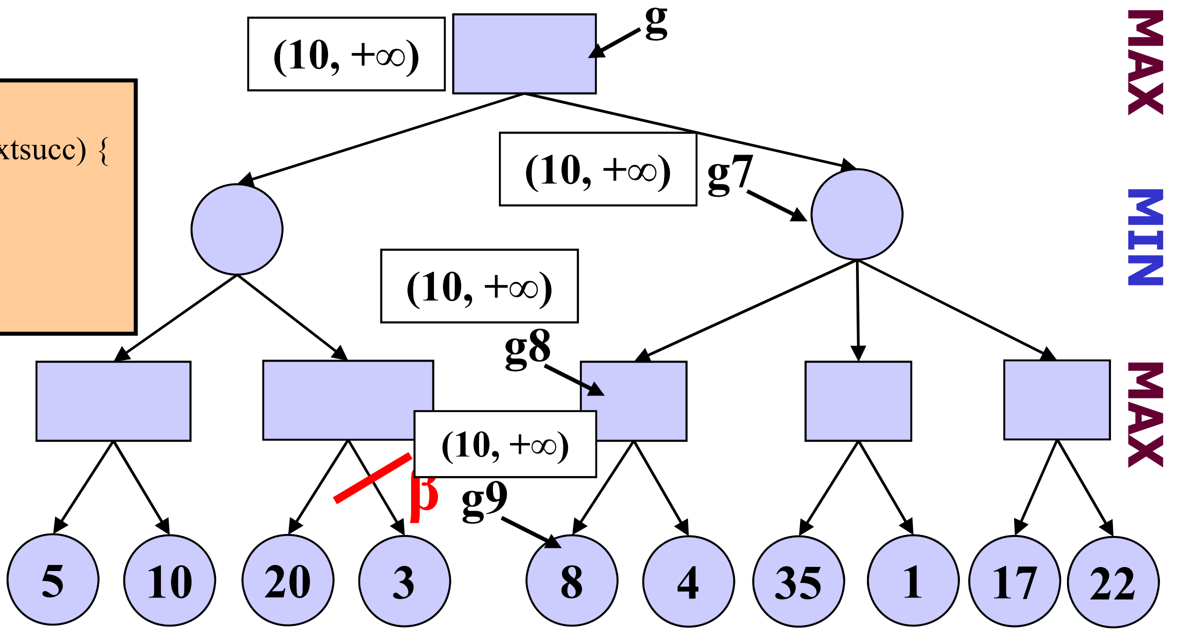
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g7.firstsucc; s != g7.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

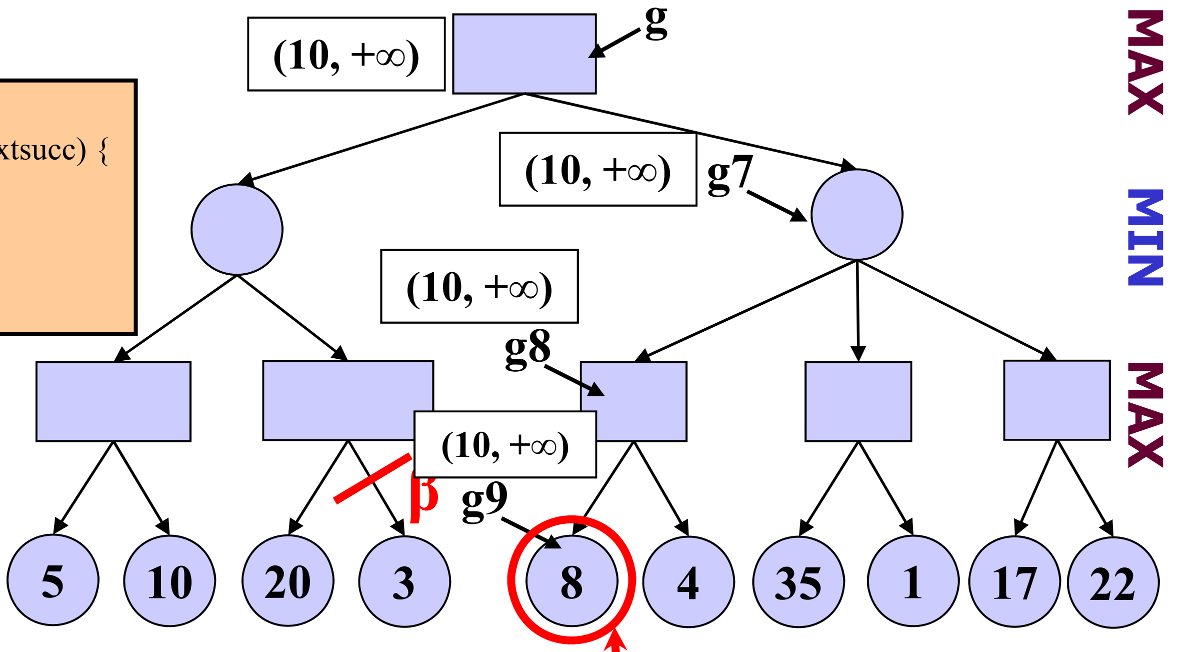
```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g9, 10, +∞)



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g7.firstsucc; s != g7.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

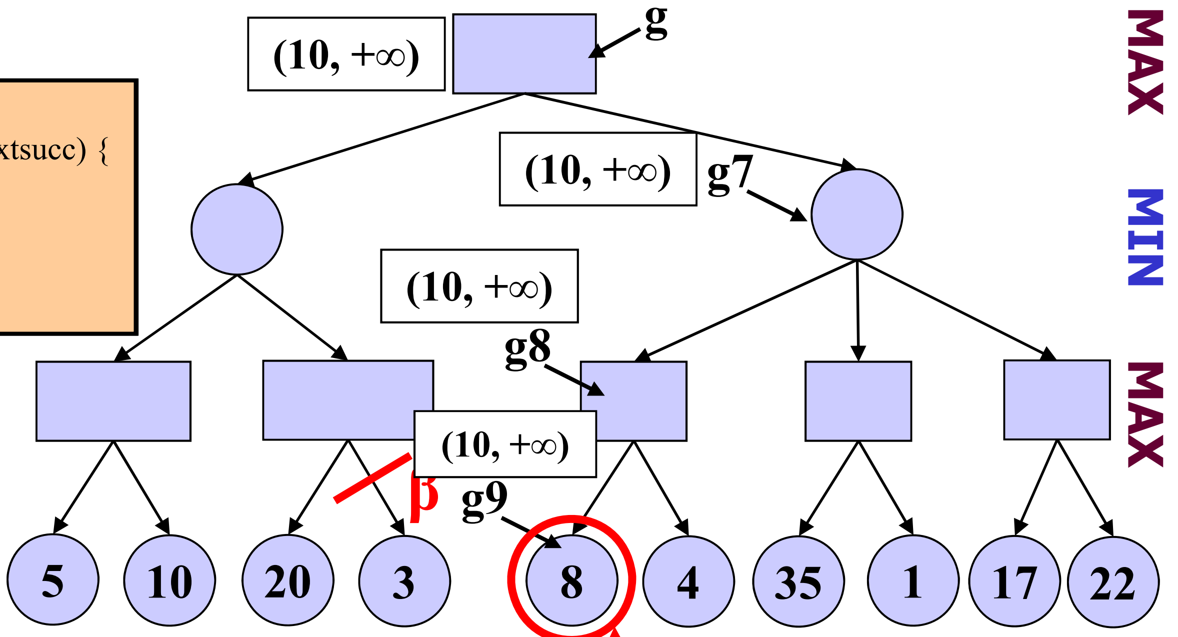
```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g9, 10, +∞)

```
cutofftest(g9)) → true!!
```

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g7, 10, +∞)

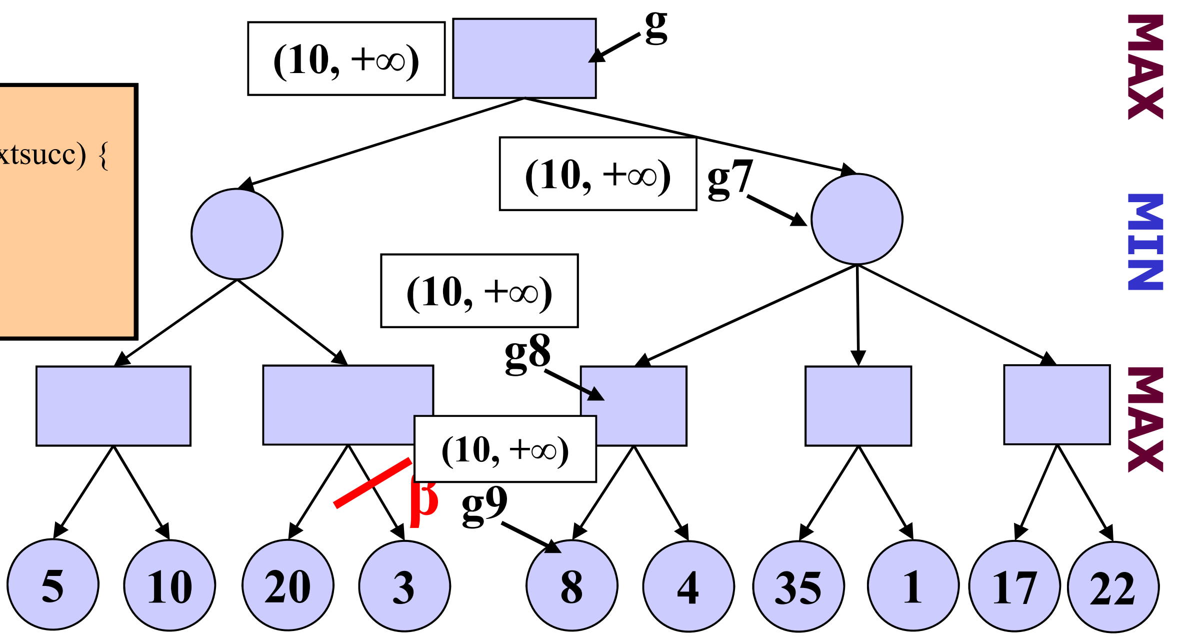
```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g9, 10, +∞)

```
cutofftest(g9)) → true!!
⇒ eval(g9) = 8
⇒ return 8
```



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g9, 10, +∞)

```
cutofftest(g9)) → true!!
⇒ eval(g9) = 8
⇒ return 8
```

Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g7, 10, +∞)

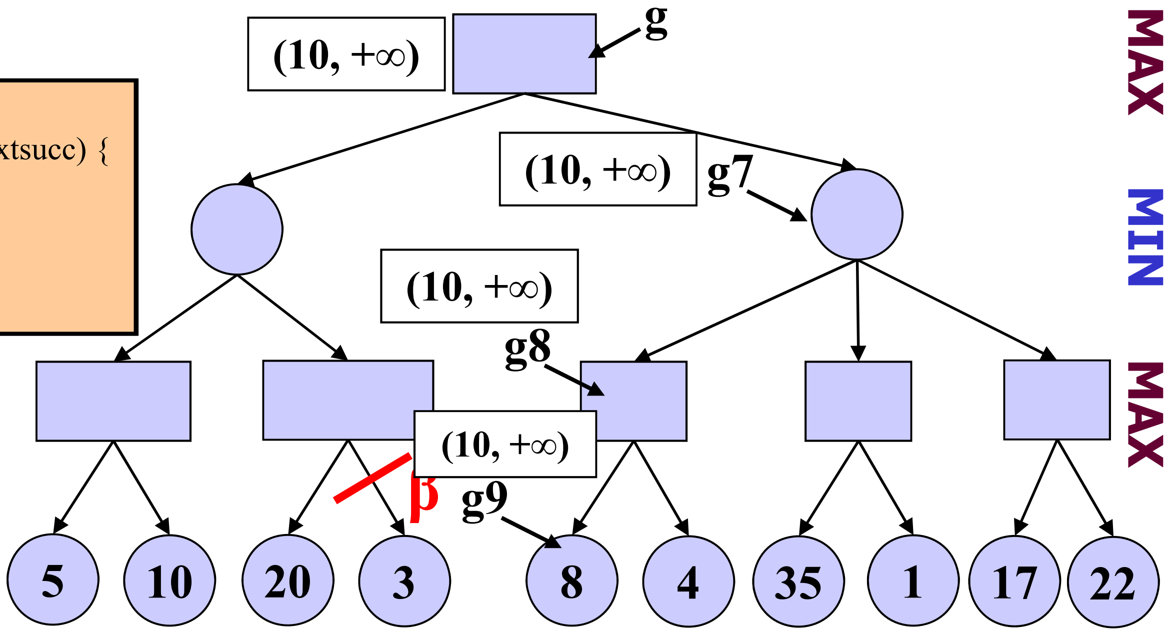
```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , 8);
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g9, 10, +∞)

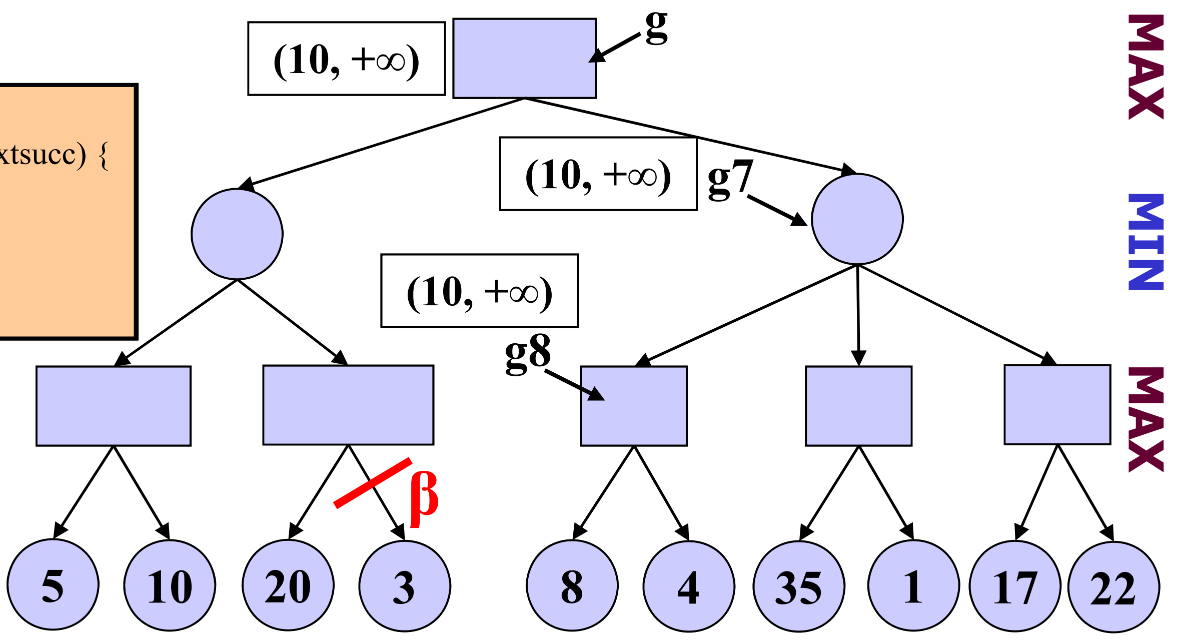
```
cutofftest(g9)) → true!!
⇒ eval(g9) = 8
⇒ return 8
```



```
maxValue(g, - ∞,+ ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g7, 10, +∞)

cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

```
maxValue(g8, 10, +∞)

cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = 10;
        if ( α  ≥ +∞ ) break;
}
return α;
```



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

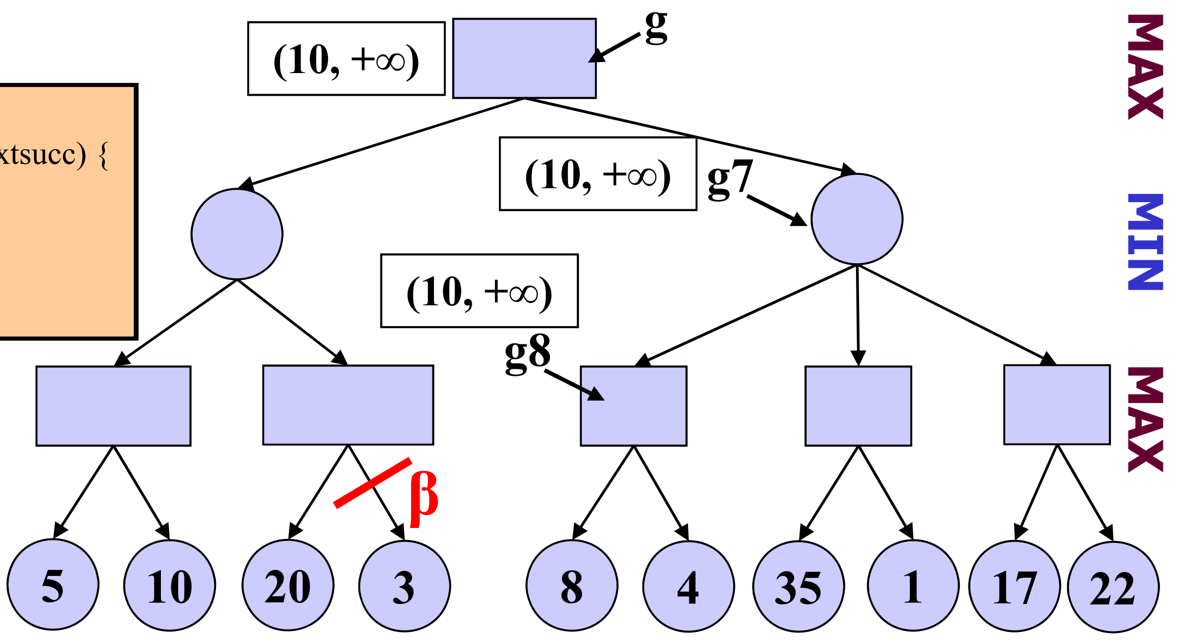
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = 10
        if ( 10  ≥ +∞ ) break;
}
return α;
```

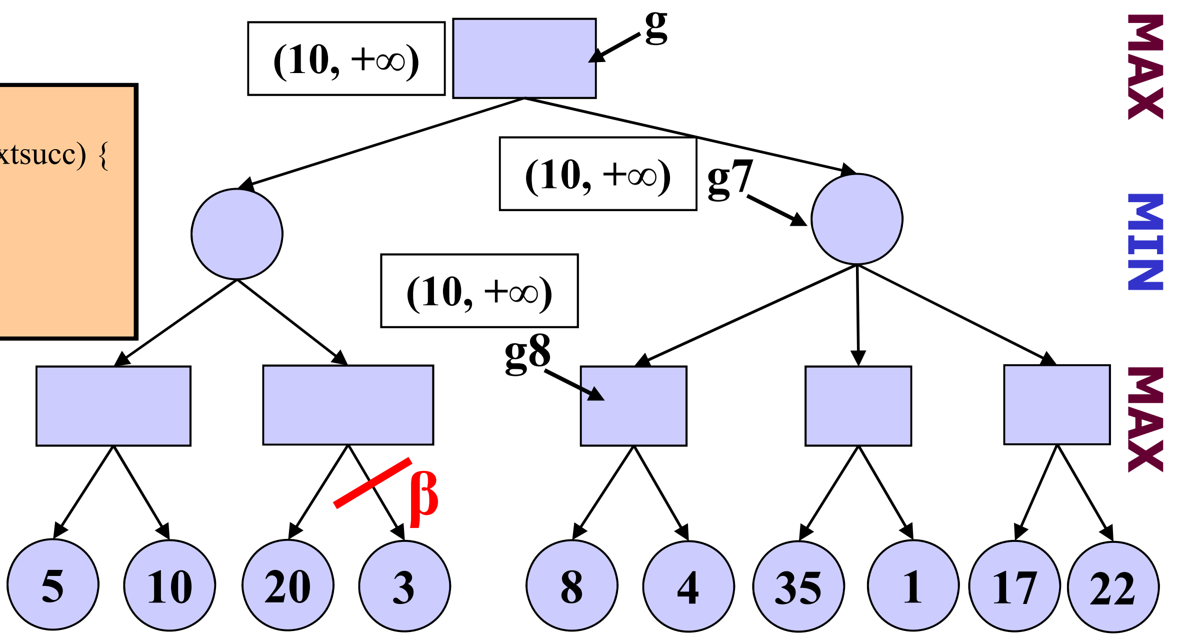
false!



Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥+∞ ) break;
}
return α;
```

next successor

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

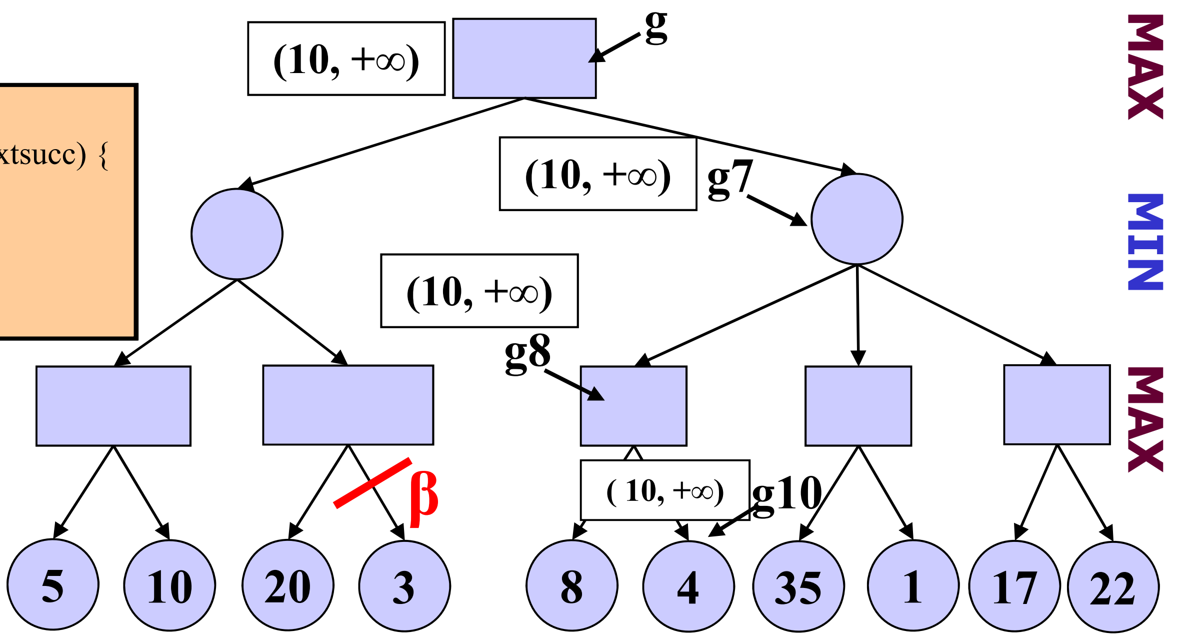
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g10, 10, +∞)

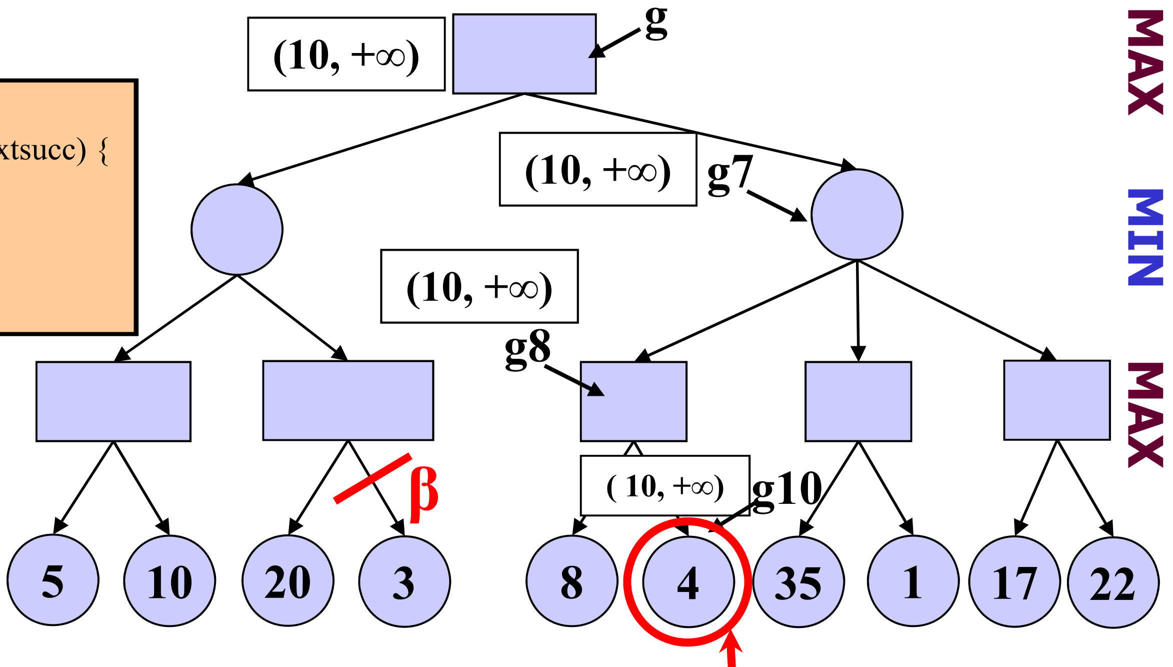


```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g7, 10, +∞)
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

```
maxValue(g8, 10, +∞)
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

```
minValue(g10, 10, +∞)
cutofftest(g10)) → true!!
```



Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g7, 10, +∞)

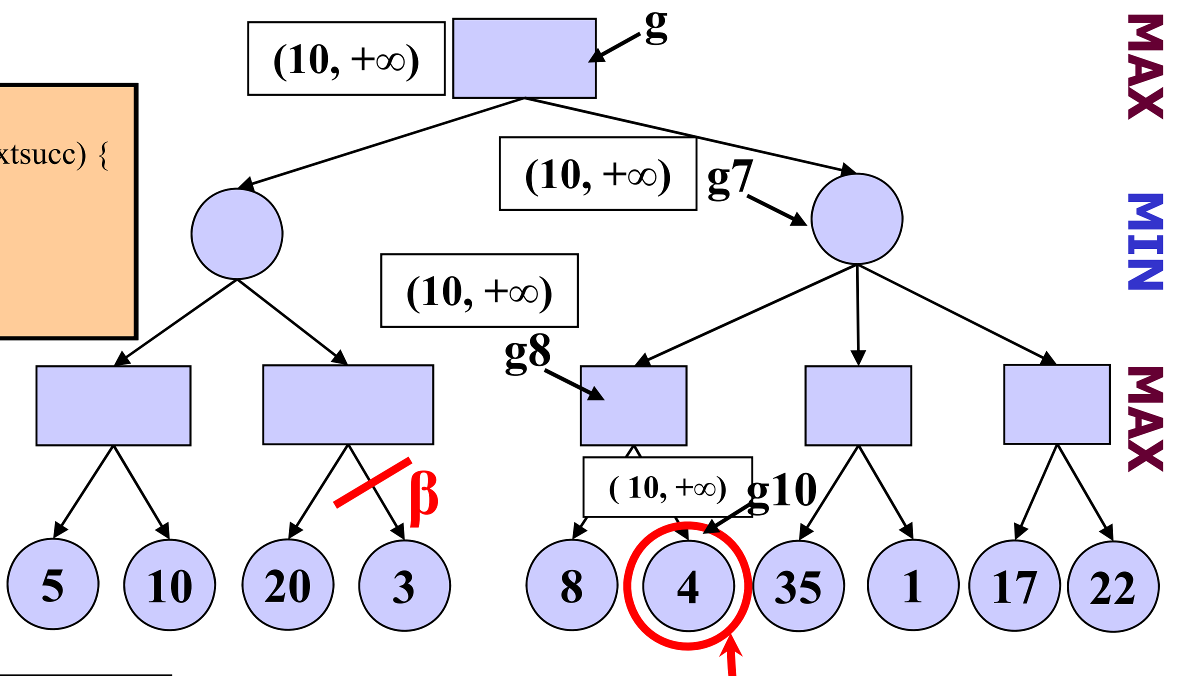
```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

minValue(g10, 10, +∞)

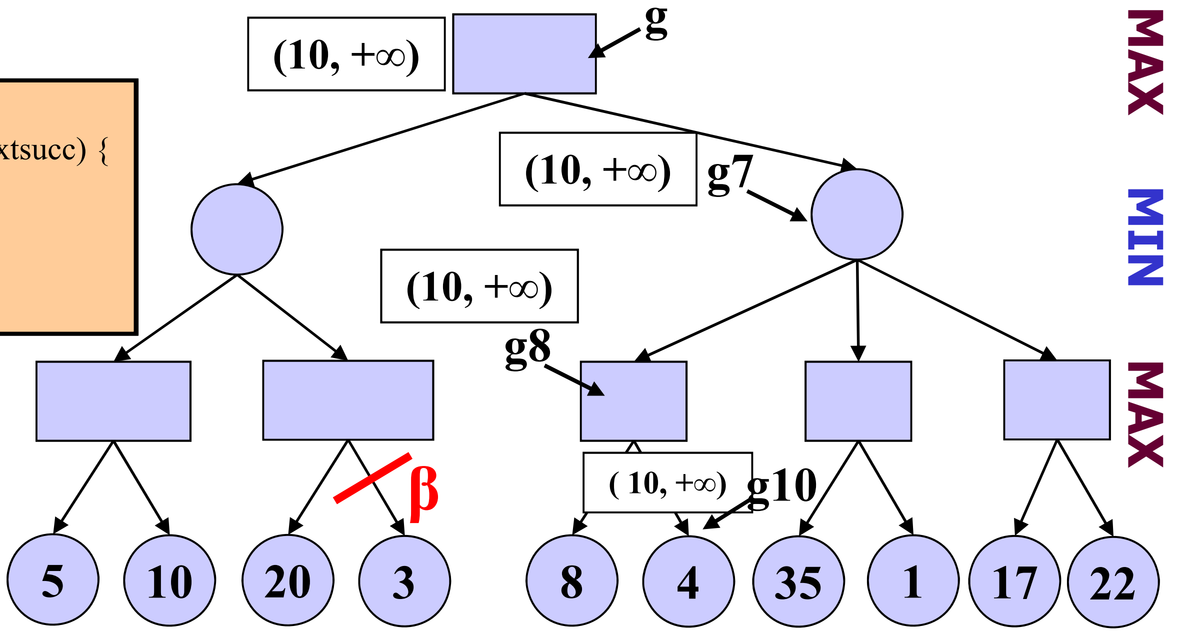
```
cutofftest(g10)) → true!!
 eval(g10) = 4
 return 4
```



Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```



minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β ≤ 10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α ≥ +∞ ) break;
}
return α;
```

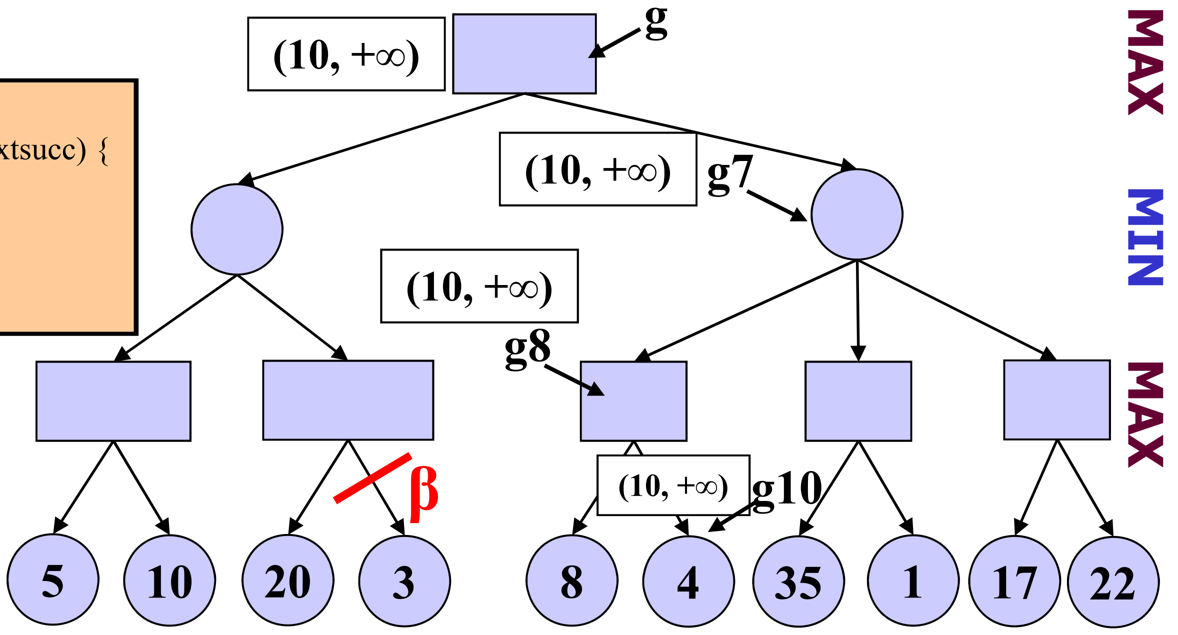
minValue(g10, 10, +∞)

```
cutofftest(g10)) → true!!
 eval(g10) = 4
 return 4
```

Übungsbeispiel α-β-Algorithmus

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```



minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β ≤ 10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , 4 );
        if ( α ≥ +∞ ) break;
}
return α;
```

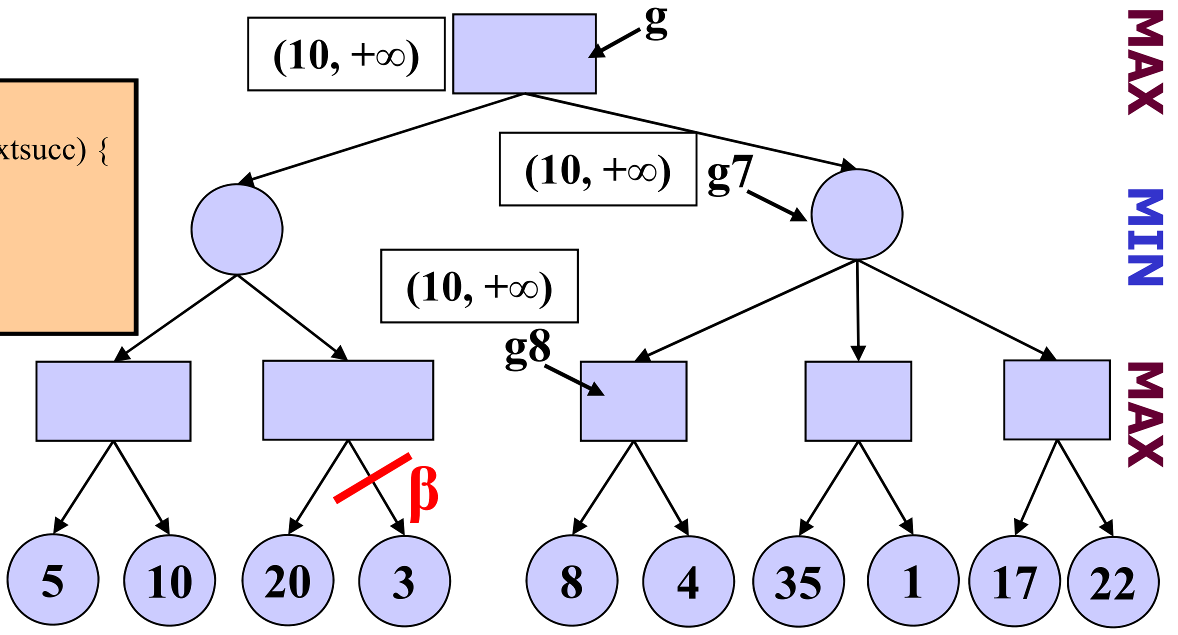
minValue(g10, 10, +∞)

```
cutofftest(g10)) → true!!
 eval(g10) = 4
 return 4
```

```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

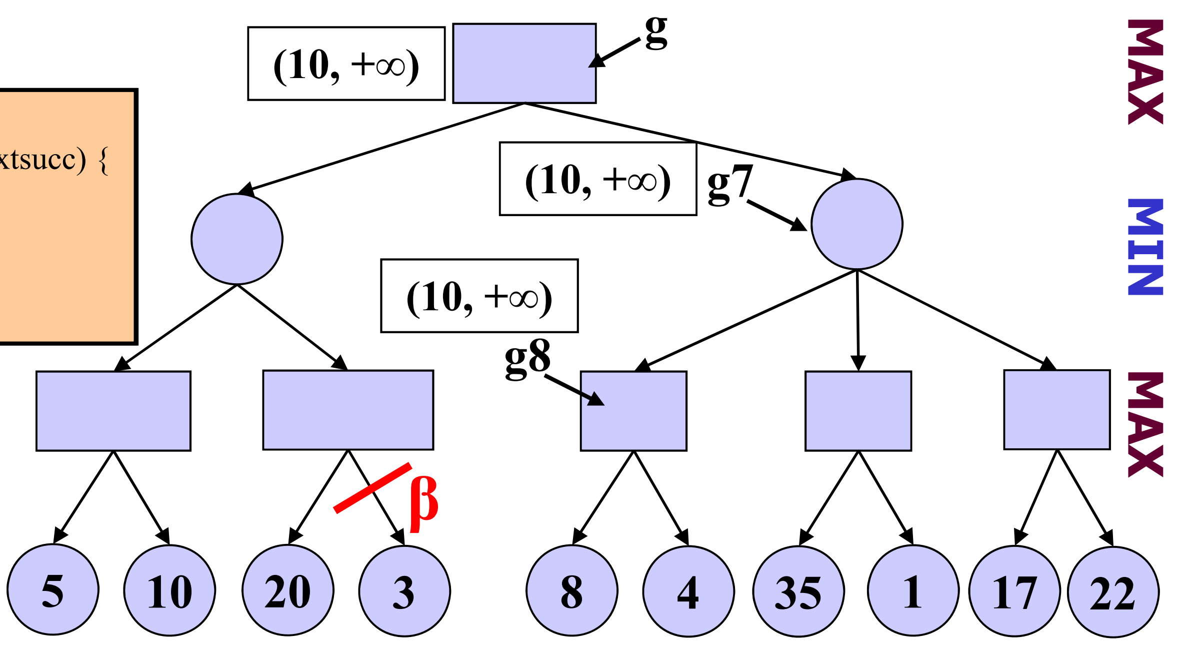
```
minValue(g7, 10, +∞)
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

```
maxValue(g8, 10, +∞)
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α =10;
        if ( α  ≥ +∞ ) break;
}
return α;
```



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```



minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = 10 ;
        if ( 10  ≥ +∞ ) break;
}
return α;
```

false!

maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

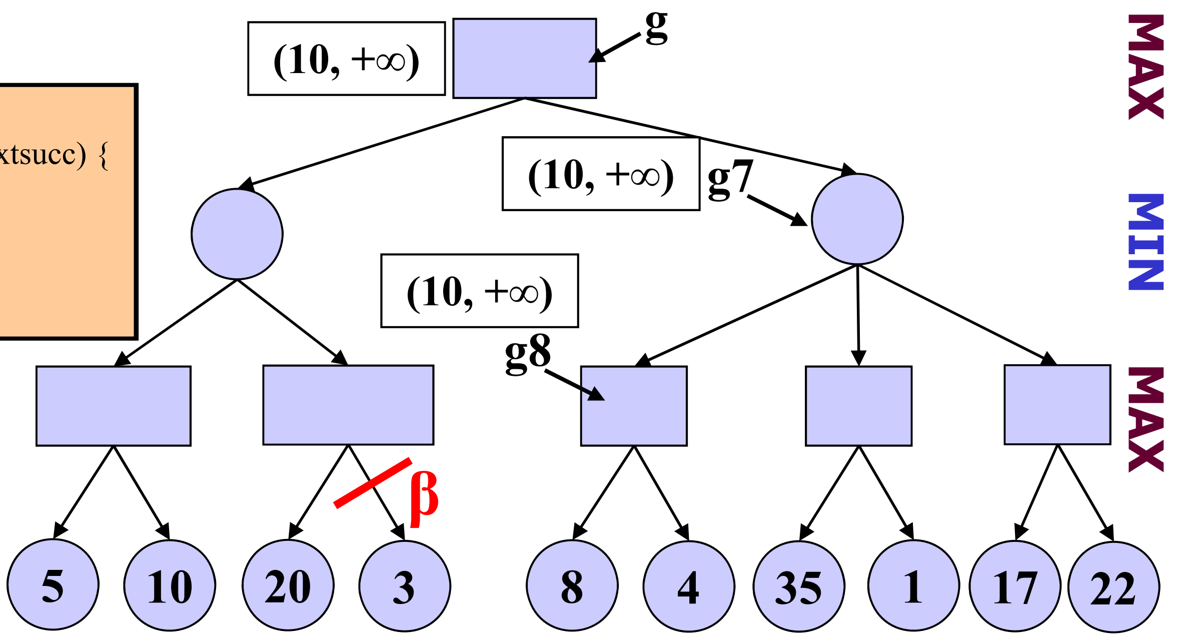
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = max( 10 , minValue(s, 10, +∞));
        if ( α  ≥ +∞ ) break;
}
return α;
```

g8 has no more successors!



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

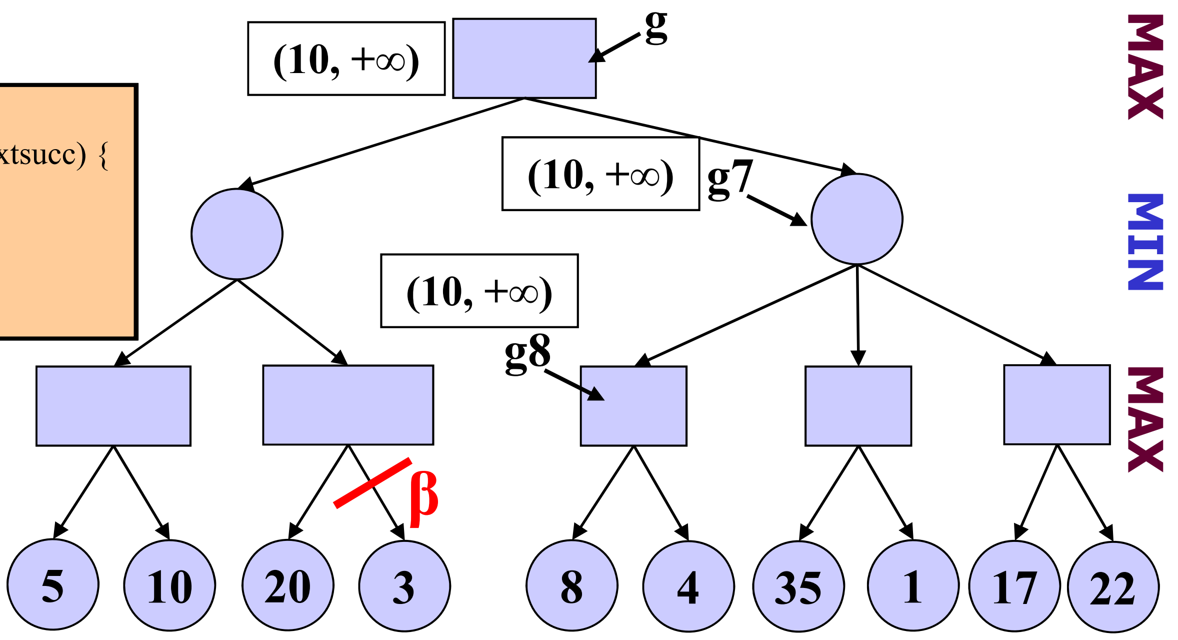
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , maxValue(s, 10, +∞));
        if ( β  ≤  10 ) break;
}
return β;
```

maxValue(g8, 10, +∞)

```
cutofftest(g8) → false
for (GameState s = g8.firstsucc; s != g8.lastsucc; s = s.nextsucc) {
        α = 10 ;
        if ( 10  ≥ +∞ ) break;
}
return 10;
```

g8 has no more successors!

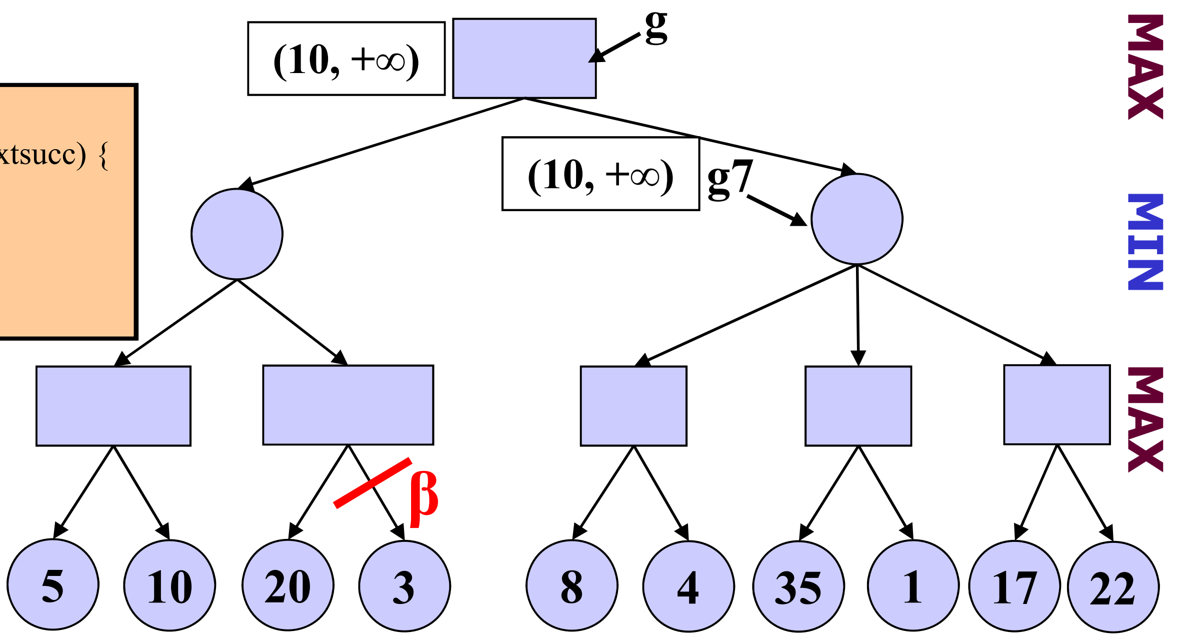


maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = min(+∞ , 10);
        if ( β  ≤  10 ) break;
}
return β;
```

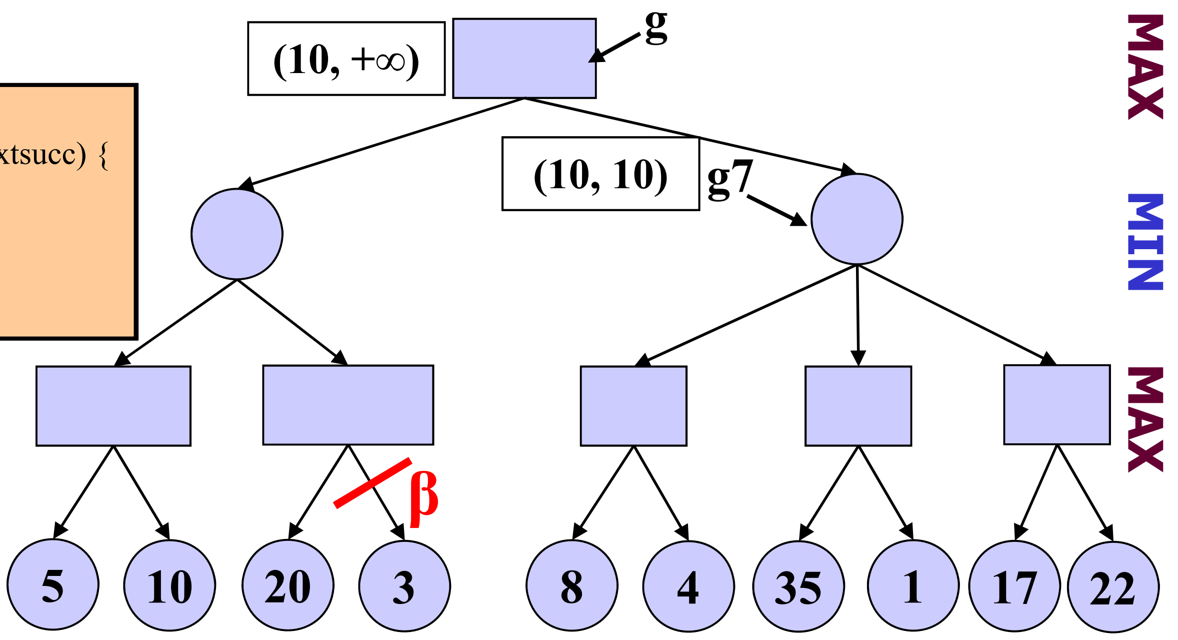


maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α ≥ +∞) break;
}
return α;
```

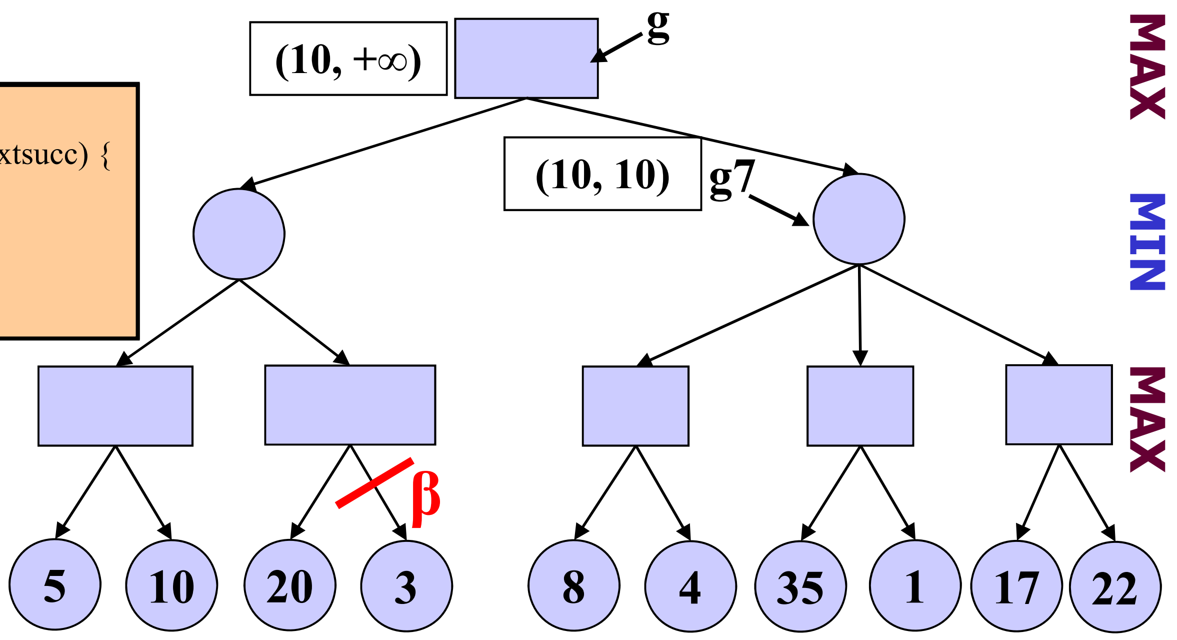
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( β ≤ 10 ) break;
}
return β;
```



```
maxValue(g, - ∞,+ ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g7, 10, +∞)

cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤  10 ) break;
}
return β;              true!
```

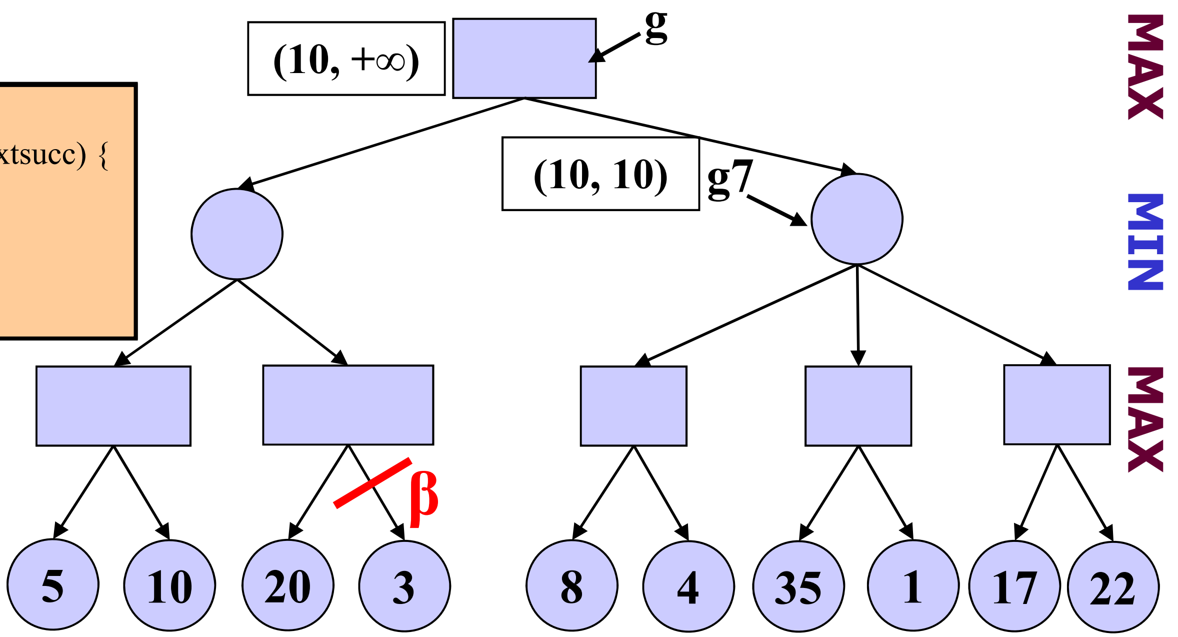


maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

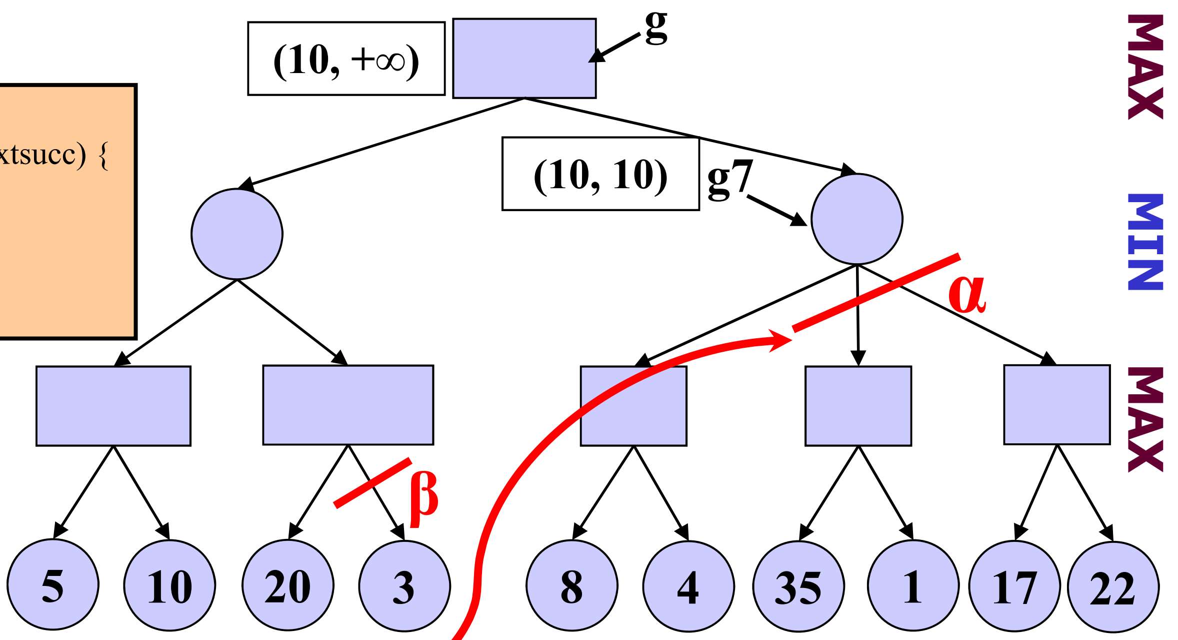
minValue(g7, 10, +∞)

```
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤  10 ) break;
}
return β;
```



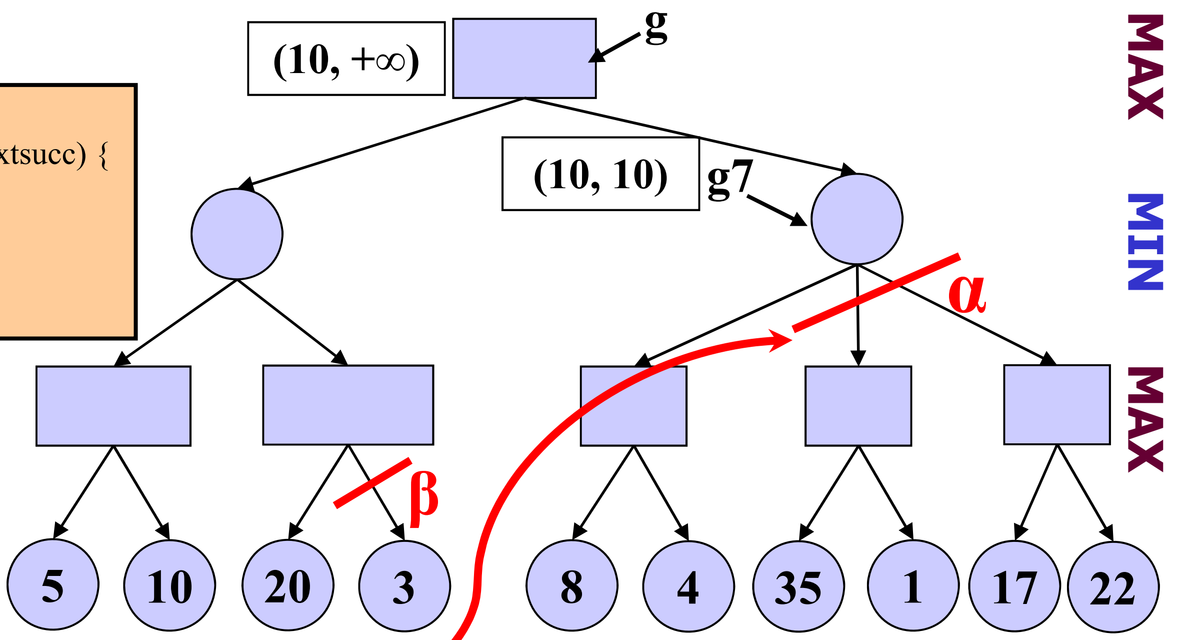
```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g7, 10, +∞)
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤  10 ) break;  // α Schnitt!!
}
return 10;
```



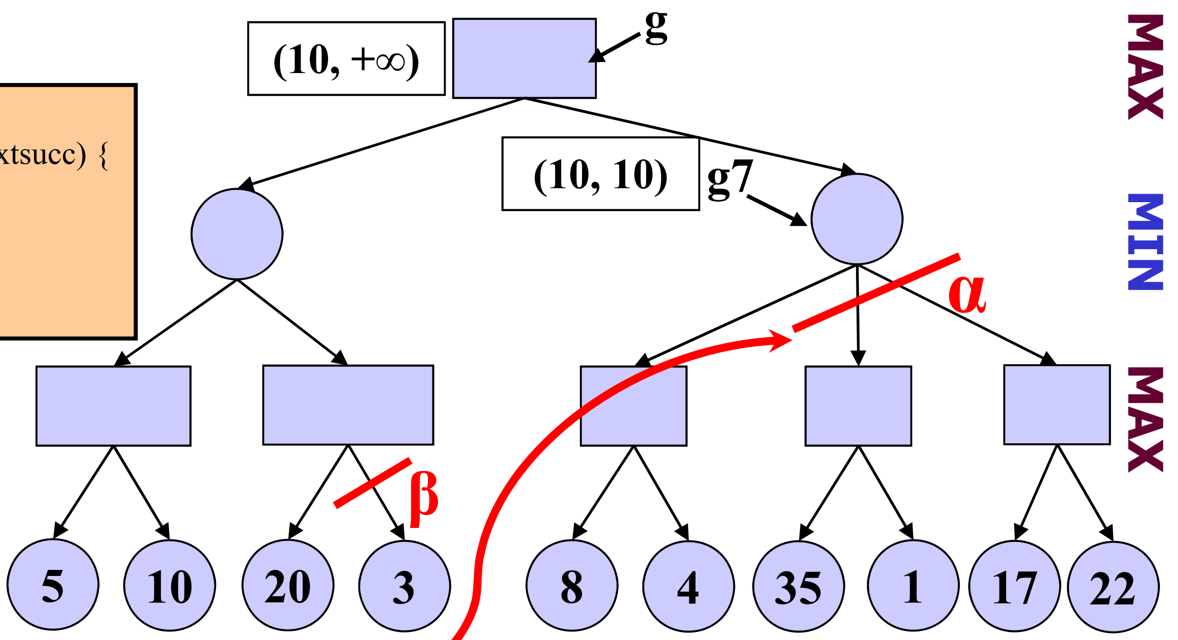
```
maxValue(g, - ∞,+ ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , minValue(s, 10, +∞) );
        if ( α  ≥+∞) break;
}
return α;
```

```
minValue(g7, 10, +∞)

cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤  10 ) break;  // α Schnitt!!
}
return 10;
```



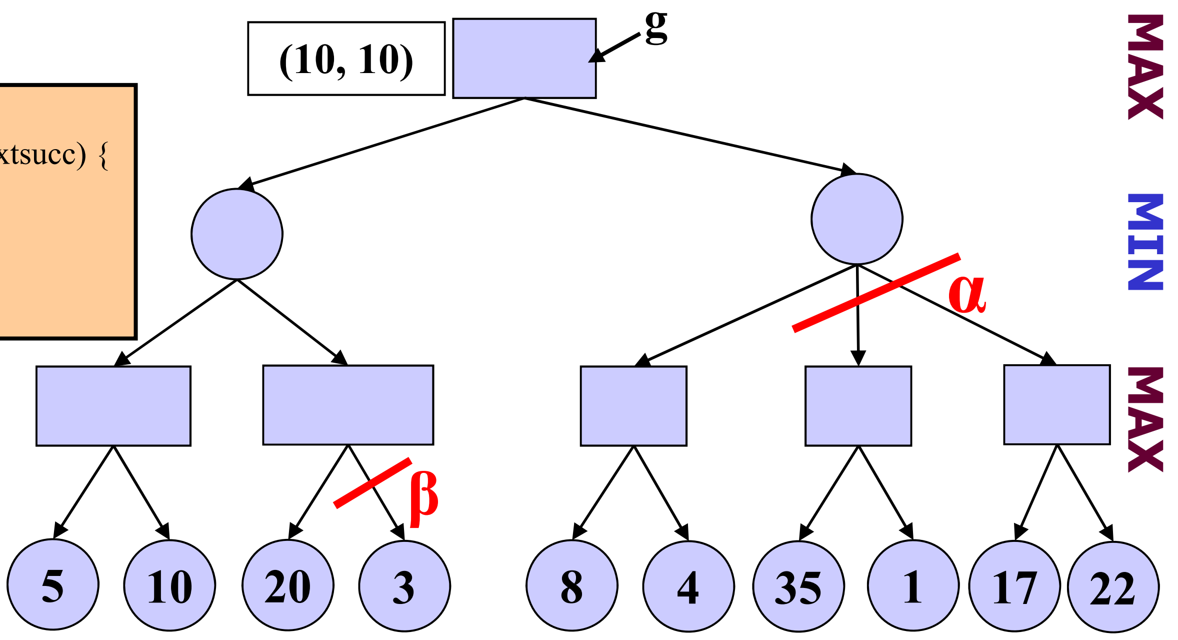
```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
        α = max(10 , 10);
        if ( α  ≥ +∞) break;
}
return α;
```

```
minValue(g7, 10, +∞)
cutofftest(g7)) → false
for (GameState s = g1.firstsucc; s != g1.lastsucc; s = s.nextsucc) {
        β = 10;
        if ( 10  ≤  10 ) break;  // α Schnitt!!
}
return 10;
```



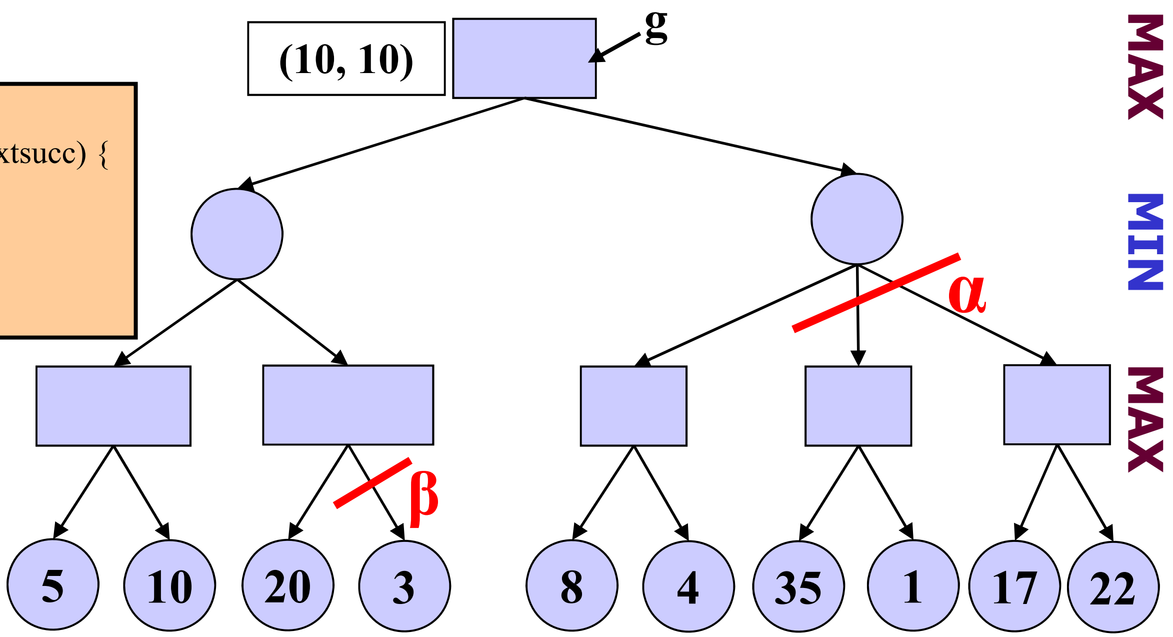
maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
    α = 10
    if ( α ≥ +∞) break;
}
return α;
```



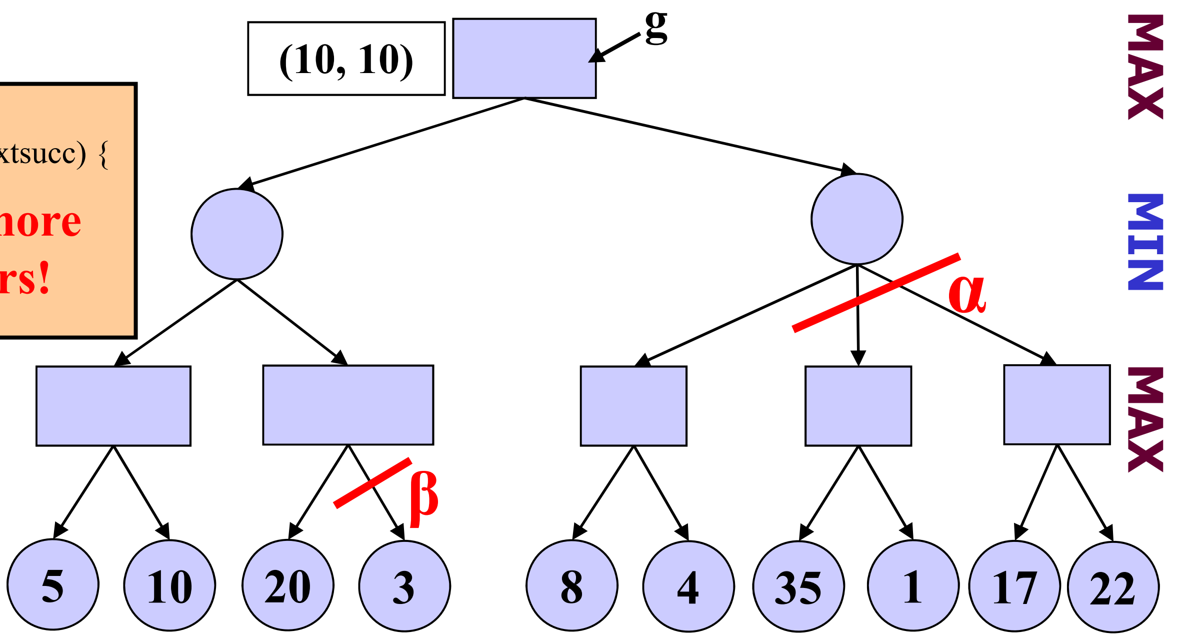
```
maxValue(g, - ∞,+ ∞)
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
    α = 10;
    if ( 10 ≥ +∞) break;
}
return α;
```

false!



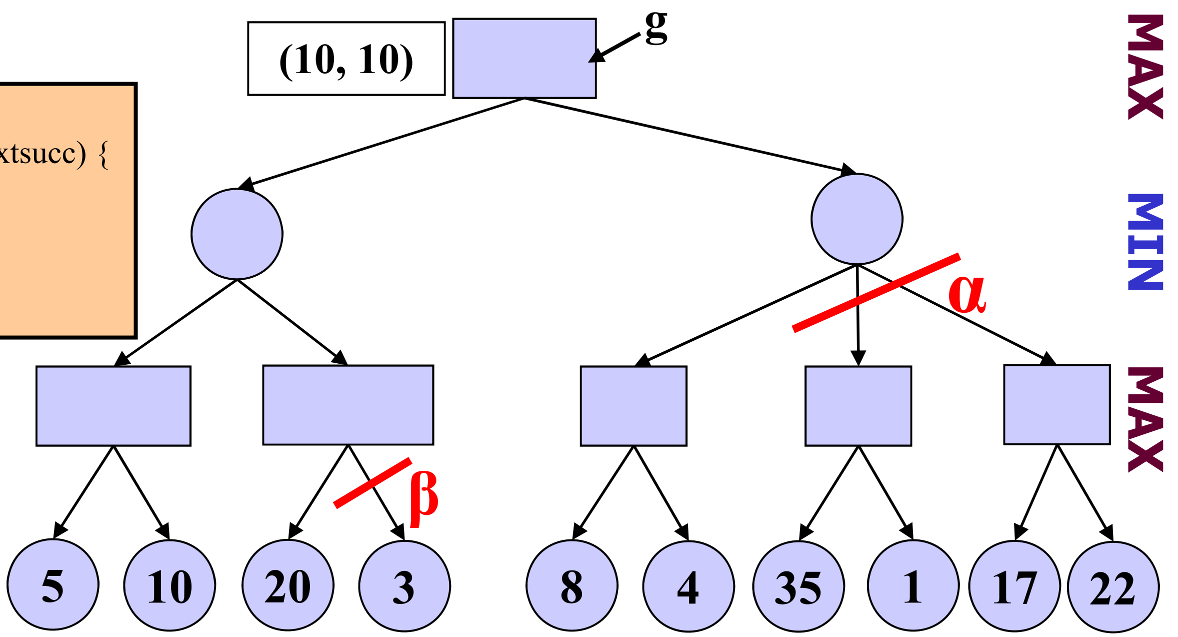
```
maxValue(g, - ∞,+ ∞)

cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
    α = 10;
    if ( 10 ≥ +∞) break;
}
return 10;
```

g has no more successors!



maxValue(g, - ∞,+ ∞)

```
cutofftest(g) → false
for (GameState s = g.firstsucc; s != g.lastsucc; s = s.nextsucc) {
      α = 10;
      if ( 10  ≥ +∞) break;
}
return 10;
```



Maximum yield from current position is 10

THE END
A Silvia Santini Picture