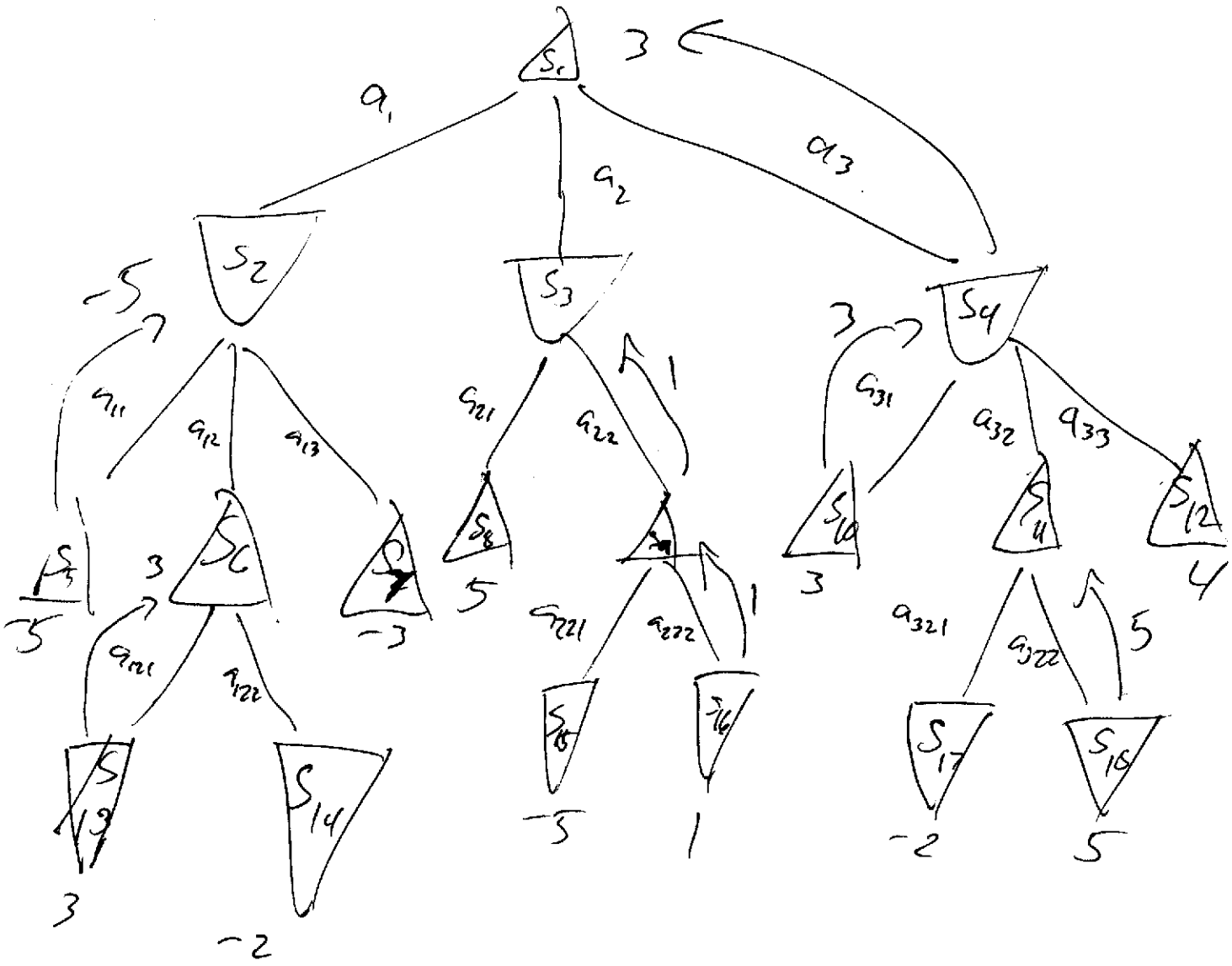
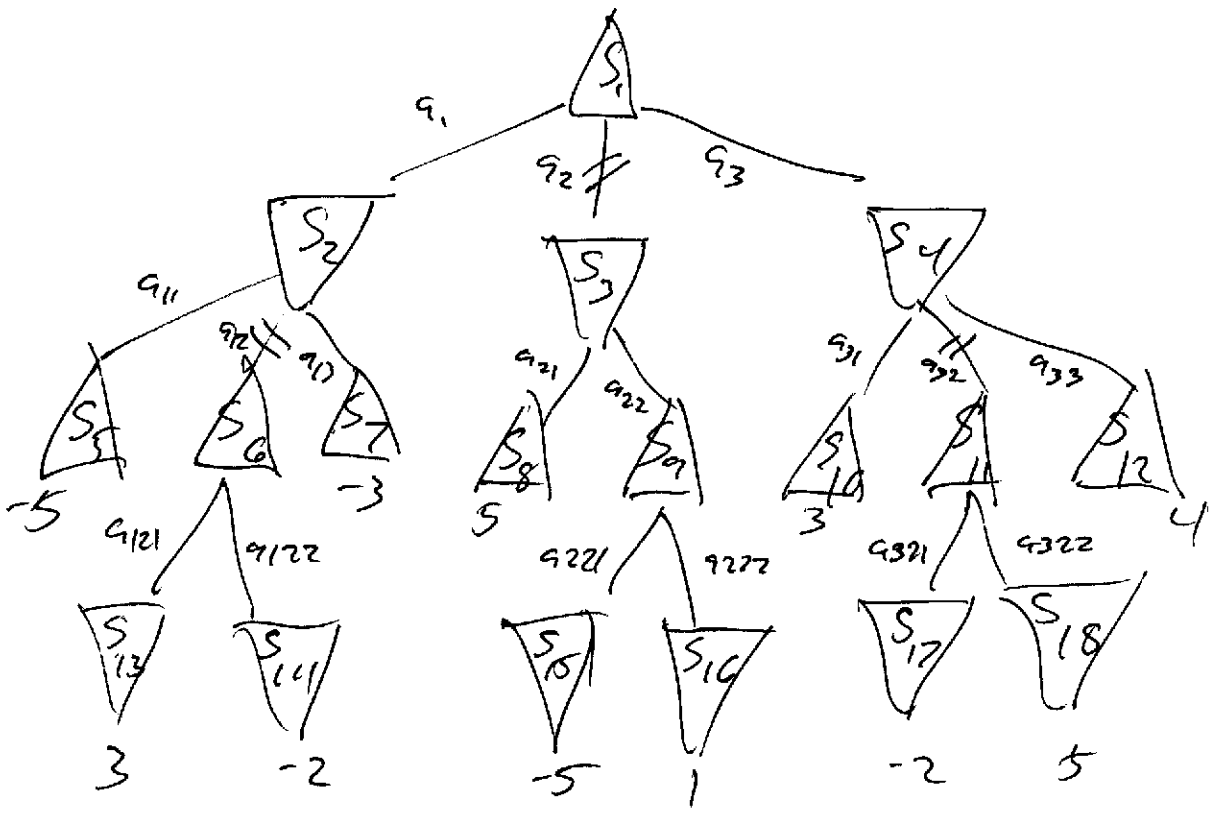
1.



Path: a_3, a_{31}

$S_1 = 3$

2.



$S_1 - -\infty, \infty$

$S_2 - -\infty, \infty$

S_5 - return -5

$S_2 - -5, \infty$

$S_6 - -5, \infty$

S_{13} - returns 3

S_6 - [redacted], prune

3 2 -5

S_{14} - returns -2

$S_6 - -2$ 2 -5, prune

prune S_6

S_7 - return -3

$S_2 - -5, \infty$

$S_1 - -5, \infty$

$S_1 - -5, \infty$

$S_3 - -5, \infty$

S_8 - ~~3 4 5~~ returns 5

$S_9 - -5, 5$ prune

S_{15} - returns -5

$S_9 - -5, 5$ no change prune

S_{16} - returns 1

$S_9 - -5, 5$ prune

$S_1 - -5, \infty$

$S_4 - -3, \infty$

S_{10} - returns 3

$S_4 - -5, 3$

$S_{11} - -5, 3$

S_{17} - returns -2

S_{11} - no change

S_{18} - returns 5

S_{11} - no change

$S_4 - -5, 3$

S_{12} - returns 4

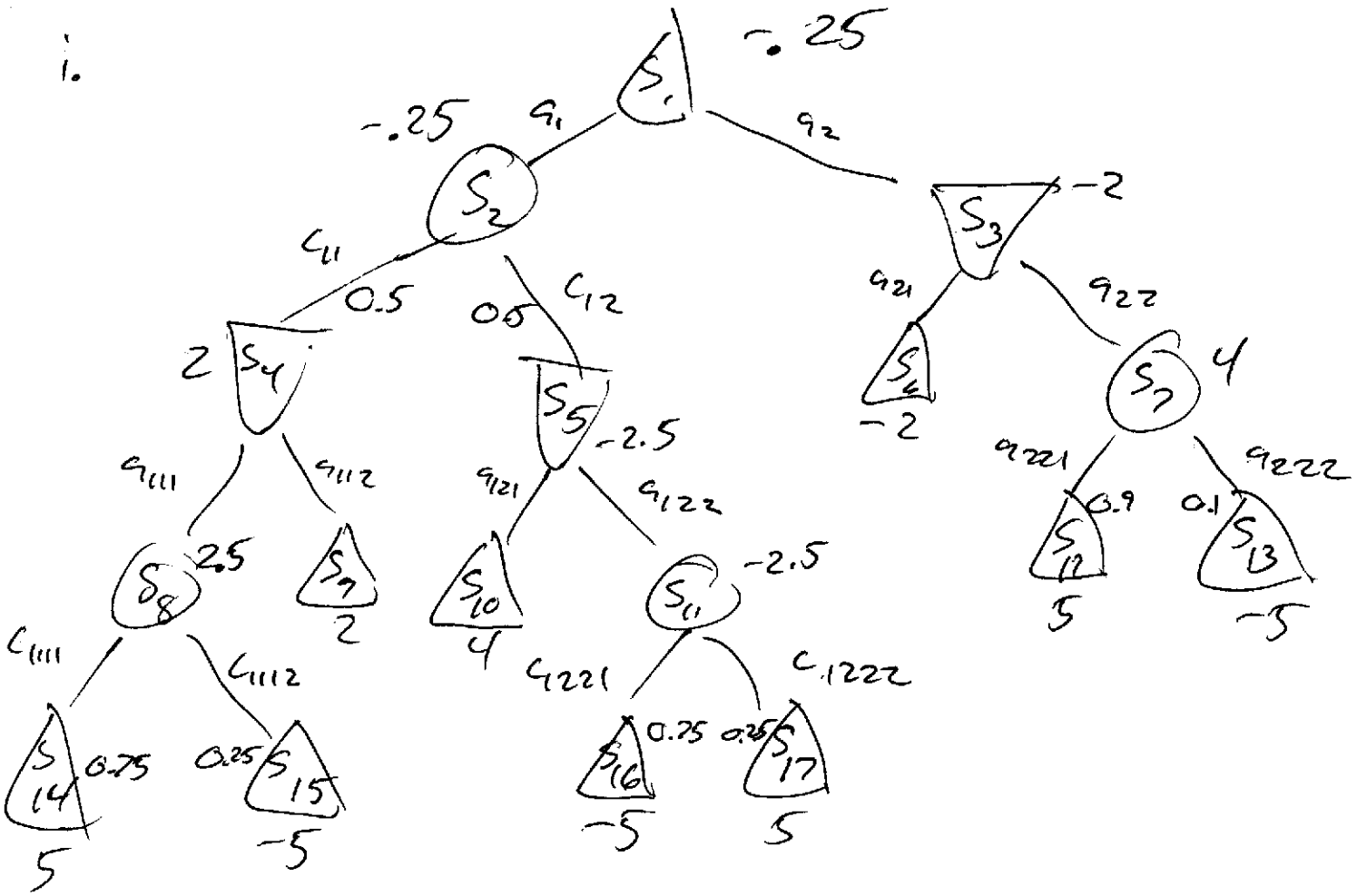
S_4 - no change

~~S_1~~ $S_1 - -5, 3$

result is still 3.

3.

i.



$S_6 = 5(3/4) + -5(1/4) =$ ~~13/4~~ $13/4 - 5/4 = 10/4 = 2.5$

$S_{11} = -5(3/4) + 5(1/4) = -15/4 + 5/4 = -10/4 = -2.5$

$S_7 = 5(9/10) - 5(1/10) = 45/10 - 5/10 = 4$

$S_2 = 2(\frac{1}{2}) - 2.5(\frac{1}{2}) = 1 - 1.25 = -.25$

$S_1 = -.25$

ii Actions selected: $a_1 \rightarrow c_{12} \rightarrow a_{122} \rightarrow c_{1222}$ (Action tree)

$\hookrightarrow c_{1221}$

$\hookrightarrow c_{11} \rightarrow a_{111} \rightarrow c_{1111}$

$\hookrightarrow c_{1112}$

iii if optimal opponent

~~assume chance works in favor of opponent~~

payoffs: -5 or 5 (S_{16} or S_{17}) or 2 (S_9)

iv opponent of unknown strategy

payoffs: -5 or 5 ($S_{14} - S_{17}$)

~~also 2 or 4 if opponent strategy works~~

4. KB: $((U \vee P) \Leftrightarrow (Q \wedge S)) \wedge (P \Leftrightarrow T) \wedge T \wedge (S \Rightarrow R)$

$\alpha = (Q \wedge R)$

elim. $\Leftrightarrow$

$$((U \vee P) \Rightarrow (Q \wedge S)) \wedge ((Q \wedge S) \Rightarrow (U \vee P)) \wedge ((P \Rightarrow T) \wedge (T \Rightarrow P)) \wedge T \wedge (S \Rightarrow R)$$

elim. $\Rightarrow$

$$(\neg(U \vee P) \vee (Q \wedge S)) \wedge (\neg(Q \wedge S) \vee (U \vee P)) \wedge ((\neg P \vee T) \wedge (\neg T \vee P)) \wedge T \wedge (\neg S \vee R)$$

Move $\neg$ inwards

$$((\neg U \wedge \neg P) \vee (Q \wedge S)) \wedge ((\neg Q \vee S) \vee (U \vee P)) \wedge ((\neg P \vee T) \wedge (\neg T \vee P)) \wedge T \wedge (\neg S \vee R)$$

~~$T \wedge (\neg S \vee R) \equiv ((T \wedge \neg S) \vee (T \wedge R))$~~

~~$((\neg P \vee T) \wedge (\neg T \vee P)) \wedge ((T \wedge \neg S) \vee (T \wedge R))$~~

$(\neg U \wedge \neg P) \vee (Q \wedge S) \equiv (\neg U \wedge \neg P \wedge Q) \vee (\neg U \wedge \neg P \wedge S)$

$((\neg U \wedge \neg P) \vee (Q \wedge S)) \vee ((\neg Q \vee \neg S) \vee (U \vee P)) \equiv (\neg Q \vee \neg S \vee \neg(Q \wedge S))$

$$(\neg U \wedge \neg P \wedge Q) \vee (\neg U \wedge \neg P \wedge S) \wedge ((\neg Q \vee \neg S) \vee (U \vee P)) \wedge ((\neg P \vee T) \wedge (\neg T \vee P)) \wedge T \wedge (\neg S \vee R)$$

$$\frac{T, \neg T \vee P}{P}$$

$$\frac{\neg(U \vee P) \vee (Q \wedge S), \neg(Q \wedge S) \vee (U \vee P)}{(Q \wedge S) \vee \neg(Q \wedge S)}$$

4. $(\neg U \wedge \neg P \wedge Q) \vee (\neg U \wedge \neg P \wedge S) \wedge (\neg Q \vee \neg S) \vee (U \vee P))$
$\wedge ((\neg P \vee T) \wedge (\neg T \vee P)) \wedge T \wedge (\neg S \vee R)$

$\frac{T, \neg T \vee P}{P}$

$\frac{P, \neg U \wedge \neg P \wedge S}{\neg U \wedge S}$

$\frac{P, \neg U \wedge \neg P \wedge Q}{\neg U \wedge Q}$

~~$\neg U \wedge S, \neg S \vee R$~~
~~$\neg U \vee R$~~

$\neg U \wedge Q \equiv U \vee \neg Q$

~~$\neg\neg(Q \wedge \neg S)$~~

~~$U \vee \neg S$~~

$(\neg U \wedge \neg P \wedge Q) \vee (\neg U \wedge \neg P \wedge S) \equiv$
$\neg(U \vee P \vee Q) \vee \neg(U \vee P \vee S)$
$\neg((U \vee P \vee Q) \wedge (U \vee P \vee S))$

I don't think KB entails α

3. $(\forall x)(\forall y)[Fast(x) \wedge Tall(y) \Rightarrow Stranger(x,y)]$

Fast(Tom)
Tall(Richard)
Fast(Harry)

i. 2 pred. ~~[illegible]~~ with one argument
1 pred. with 2 arguments
3 constants
~~[illegible]~~
There are 2^{10} Symbols need to convert Any KB

$2^{1^3+1^3} = 2^2$

$2^{2^3} = 2^8$

~~[illegible]~~ 2^2

2^{10}

ii. Fast(Tom) $\wedge$ Tall(Richard) $\Rightarrow$ Stranger(Tom, Richard)
Fast(Tom)
Tall(Richard)
Fast(Harry)

$\Downarrow$

Fast_Tom $\wedge$ Tall_Richard $\Rightarrow$ Stranger_Tom_Richard
Fast_Tom
Tall_Richard
Fast_Harry

iii. $\forall x \forall y$ Fast(x) $\wedge$ Tall(y) $\Rightarrow$ Stranger(Tom, Richard)
Fast(Tom)
Tall(Richard)
Fast(Harry)
$\forall y$ Fast(Harry) $\wedge$ Tall(y) $\Rightarrow$ Stranger(Harry, y)
Fast(Harry) $\wedge$ Tall(Richard) $\Rightarrow$ Stranger(Harry, Richard)
Fast(Harry) $\wedge$ Tall(Richard)

Stranger(Harry, Richard) ✓