

## 1 Textual

1.  $(\forall o) \text{occurrence\_of}(o, \text{Recipe1}) \supset (\exists o1, o2, o3, o4, o5, x) \text{occurrence\_of}(o1, \text{Step1}(x)) \wedge \text{occurrence\_of}(o2, \text{Step2}(x)) \wedge \text{occurrence\_of}(o3, \text{Step3}(x)) \wedge \text{occurrence\_of}(o4, \text{Step4}(x)) \wedge \text{occurrence\_of}(o5, \text{Step5}(x)) \wedge \text{next\_subacc}(o1, o2) \wedge \text{next\_subacc}(o2, o3) \wedge \text{next\_subacc}(o3, o4) \wedge \text{next\_subacc}(o4, o5)$
2.  $(\forall o) \text{occurrence\_of}(o, \text{Step1}) \supset (\exists o1, o2, o3, o4, a) \text{combine}(a) \wedge \text{occurrence\_of}(o1, a) \wedge \text{occurrence\_of}(o2, \text{PressAir}(x) \wedge \text{Bag}(x)) \wedge \text{occurrence\_of}(o3, \text{Seal}(x)) \wedge \text{occurrence\_of}(o4, \text{Refrigerate}(x)) \wedge \text{greaterEq\_duration}(\text{duration\_of}(o4), \text{multduration}(12, \text{hour})) \wedge \text{next\_subacc}(o1, o2) \wedge \text{next\_subacc}(o2, o3) \wedge \text{next\_subacc}(o3, o4)$
3.  $(\forall a) \text{combine}(a) \wedge \text{occurrence\_of}(o1, a) \supset (\exists x1..x8) \text{buttermilk}(x1) \wedge \text{mustard}(x2) \wedge \text{hotsauce}(x3) \wedge \text{onionpowder}(x4) \wedge \text{salt}(x5) \wedge \text{blackpepper}(x6) \wedge \text{thyme}(x7) \wedge \text{chicken}(x8) \wedge \text{participates}(x1, o1) \wedge \text{participates}(x2, o1) \wedge \text{participates}(x3, o1) \wedge \text{participates}(x4, o1) \wedge \text{participates}(x5, o1) \wedge \text{participates}(x6, o1) \wedge \text{participates}(x7, o1) \wedge \text{participates}(x8, o1) \wedge \text{DryMixture}(y)$
4.  $(\forall o) \text{occurrence\_of}(o, \text{Step2}) \supset (\exists o1, o2, o3, o4, o5, o6) \wedge \text{occurrence\_of}(o1, \text{Preheat}(x) \wedge \text{Oven}(x)) \wedge \text{occurrence\_of}(o2, \text{Remove}(x)) \wedge \text{occurrence\_of}(o3, \text{Arrange}(x)) \wedge \text{occurrence\_of}(o4, \text{Discard}(x) \wedge \text{Marinade}(x)) \wedge \text{occurrence\_of}(o5, \text{Roast}(x)) \wedge (\text{duration}(\text{beginof}(\text{Roast}(x)), 30) \vee \text{duration}(\text{beginof}(\text{Roast}(x)), 40)) \wedge \text{occurrence\_of}(o6, \text{Cool}(x) \vee (\text{Wrap}(x) \wedge \text{Refrigerate}(x)) \wedge \text{next\_subacc}(o1, o2) \wedge \text{occurrence\_of}(o6, \text{Cool}(x) \vee (\text{Wrap}(x) \wedge \text{Refrigerate}(x)) \wedge \text{next\_subacc}(o2, o3) \wedge \text{next\_subacc}(o3, o4) \wedge \text{next\_subacc}(o4, o5) \wedge \text{next\_subacc}(o5, o6)$
5.  $(\forall o) \text{occurrence\_of}(o, \text{Step3}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Heat}(\text{Oil}) \wedge \text{LargeDeepSkillet}(\text{Oil}))$
6.  $(\forall o) \text{occurrence\_of}(o, \text{Step4}) \supset (\exists o1, o2, o3, o4, o5, a) \text{Mix}(a) \wedge \text{occurrence\_of}(o1, a) \wedge \text{occurrence\_of}(o2, \text{Pour}(x) \wedge \text{Buttermilk}(x) \wedge \text{ShallowDish}(x)) \wedge \text{occurrence\_of}(o3, \text{Season}(x) \wedge \text{HotSauce}(x) \wedge \text{Salt}(x) \wedge \text{Pepper}(x) \wedge \text{occurrence\_of}(o4, \text{Dip}(\text{Chicken}) \wedge \text{Buttermilk}(x)) \wedge \text{occurrence\_of}(o5, \text{Add}(\text{Chicken}) \wedge \text{Flour}(x)) \wedge \text{next\_subacc}(o1, o2) \wedge \text{next\_subacc}(o2, o3) \wedge \text{next\_subacc}(o3, o4) \wedge \text{next\_subacc}(o4, o5)$
7.  $(\forall a) \text{mix}(a) \wedge \text{occurrence\_of}(o1, a) \supset (\exists x1, x2, x3, x4, x5, x6) \text{flour}(x1) \wedge \text{paprika}(x2) \wedge \text{garlicpowder}(x3) \wedge \text{salt}(x4) \wedge \text{mustard}(x5) \wedge \text{blackpepper}(x6)$
8.  $(\forall o) \text{occurrence\_of}(o, \text{Step5}) \supset (\exists o1, o2, o3, o4, o5, o6, o7, o8, o9, o10, o11) \wedge \text{occurrence\_of}(o1, \text{Fry}(x) \wedge (\text{duration}(\text{beginof}(\text{Fry}(x)), 0.3) \vee (\text{duration}(\text{beginof}(\text{Fry}(x)), 0.5) \vee (\text{duration}(\text{beginof}(\text{Fry}(x)), \text{Cooked}(x)))) \wedge \text{occurrence\_of}(o2, \text{Drain}(x)) \wedge \text{occurrence\_of}(o3, \text{Garnish}(x)) \wedge \text{occurrence\_of}(o4, \text{AddInOil}(x)) \wedge \text{occurrence\_of}(o5, \text{Fry}(x) \wedge (\text{duration}(\text{beginof}(\text{Fry}(x)), 2) \vee (\text{duration}(\text{beginof}(\text{Fry}(x)), 3) \vee (\text{duration}(\text{beginof}(\text{Fry}(x)), \text{Crispy}(x)))) \wedge \text{occurrence\_of}(o6, \text{Sprinkle}(x)) \wedge \text{occurrence\_of}(o7, \text{Transfer}(x)) \wedge \text{occurrence\_of}(o8, \text{KeepWarm}(x) \wedge \text{Fry}(x)) \wedge \text{occurrence\_of}(o9, \text{Pile}(x)) \wedge \text{occurrence\_of}(o10, \text{TopWithRosemary}(x)) \wedge \text{occurrence\_of}(o11, \text{DrizzleWithHoney}(x) \wedge \text{Present}(x))$

## 2 Auditory

$(\forall o) \text{occurrence\_of}(o, \text{Recipe1}) \supset (\exists o1, o2, o3, o4, o5, o6, o7, o8, o9, o10, o11, o12, o13, o14, o15, o16, o17, o18, o19) \text{occurrence\_of}(o1, \text{Step1}(x)) \wedge \text{occurrence\_of}(o2, \text{Step2}(x)) \wedge \text{occurrence\_of}(o3, \text{Step3}(x)) \wedge$

$occurrence\_of(o4, Step4(x)) \wedge occurrence\_of(o5, Step5(x)) \wedge occurrence\_of(o5, Step6(x)) \wedge$   
 $occurrence\_of(o3, Step7(x)) \wedge occurrence\_of(o4, Step8(x)) \wedge occurrence\_of(o5, Step9(x)) \wedge$   
 $occurrence\_of(o5, Step10(x)) \wedge occurrence\_of(o1, Step11(x)) \wedge occurrence\_of(o2, Step12(x)) \wedge$   
 $occurrence\_of(o3, Step13(x)) \wedge occurrence\_of(o4, Step14(x)) \wedge occurrence\_of(o5, Step15(x)) \wedge$   
 $occurrence\_of(o5, Step16(x)) \wedge occurrence\_of(o3, Step17(x)) \wedge occurrence\_of(o4, Step18(x)) \wedge$   
 $occurrence\_of(o5, Step19(x)) \wedge occurrence\_of(o5, Step20(x)) \wedge next\_subacc(o1, o2) \wedge$   
 $next\_subacc(o2, o3) \wedge next\_subacc(o3, o4) \wedge next\_subacc(o4, o5) \wedge next\_subacc(o5, o6) \wedge$   
 $next\_subacc(o6, o7) \wedge next\_subacc(o7, o8) \wedge next\_subacc(o8, o9) \wedge next\_subacc(o9, o10) \wedge$   
 $next\_subacc(o10, o11) \wedge next\_subacc(o11, o12) \wedge next\_subacc(o12, o13) \wedge next\_subacc(o13, o14) \wedge$   
 $next\_subacc(o14, o15) \wedge next\_subacc(o15, o16) \wedge next\_subacc(o16, o17) \wedge next\_subacc(o17, o18) \wedge$   
 $next\_subacc(o18, o19) \wedge next\_subacc(o19, o20)$

$(\forall o) occurrence\_of(o, Step1) \supset (\exists o1, a) \wedge Unknown\_Activity(a) \wedge occurrence\_of(o1, a)$

$(\forall a) Unknown\_Activity(a) \wedge occurrence\_of(o1, a) \supset (\exists x1..x6) buttermilk(x1, 2) \wedge$   
 $mustard(x2) \wedge tang(x3) \wedge onionpowder(x4) \wedge salt(x5) \wedge blackpepper(x6)$

$(\forall o) occurrence\_of(o, Step2) \supset (\exists o1) \wedge occurrence\_of(o1, Add(Heat))$

$(\forall o) occurrence\_of(o, Step3) \supset (\exists o1) \wedge occurrence\_of(o1, Unknown\_Activity(x))$

$(\forall o) occurrence\_of(o, Step4) \supset (\exists o1) \wedge occurrence\_of(o1, RemoveThymeLeaves(x))$

$(\forall o) occurrence\_of(o, Step5) \supset (\exists o1) \wedge occurrence\_of(o1, Mix(x))$

$(\forall o) occurrence\_of(o, Step6) \supset (\exists o1) \wedge occurrence\_of(o1, Add(x) \wedge Bag(x))$

$(\forall o) occurrence\_of(o, Step7) \supset (\exists o1) \wedge occurrence\_of(o1, Mix(x))$

$(\forall o) occurrence\_of(o, Step8) \supset (\exists o1) \wedge occurrence\_of(o1, Refrigerate(x)) \wedge$   
 $(duration(beginof(Refrigerate(x)), 240) \vee duration(beginof(Refrigerate(x)), 360))$

$(\forall o) occurrence\_of(o, Step9) \supset (\exists o1, o2) \wedge occurrence\_of(o1, Place(x) \wedge$   
 $Tray(x) \wedge ParchmentSheet(x)) \wedge occurrence\_of(o2, Bake(x)) \wedge$   
 $(duration(beginof(Bake(x)), 30) \vee duration(beginof(Bake(x)), 40))$

$(\forall o) occurrence\_of(o, Step10) \supset (\exists o1) \wedge occurrence\_of(o1, Fry(x))$

$(\forall o) occurrence\_of(o, Step11) \supset (\exists o1) \wedge occurrence\_of(o1, Oil(x))$

$(\forall o) occurrence\_of(o, Step12) \supset (\exists o1) \wedge occurrence\_of(o1, Add(x))$

$(\forall o) occurrence\_of(o, Step13) \supset (\exists o1, o2, b) \wedge occurrence\_of(o1, Unknown\_Activity(x)) \wedge$   
 $Season(b) \wedge occurrence\_of(o2, b) \wedge next\_subacc(o1, o2)$

$(\forall b) Season(b) \wedge occurrence\_of(o2, b) \supset (\exists x1, x2, x3, x4, x5) garlicpowder(x1) \wedge$   
 $drymustard(x2) \wedge paprika(x3) \wedge salt(x4) \wedge pepper(x5)$

$(\forall o) occurrence\_of(o, Step14) \supset (\exists o1) \wedge occurrence\_of(o1, Fry(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step15}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Garnish}(x) \wedge \text{Remove}(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step16}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Place}(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step17}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Place}(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step18}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{TurnOver}(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step19}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Unknown\_Activity}(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step20}) \supset (\exists o1, o2) \wedge \text{occurrence\_of}(o1, \text{Unknown\_Activity}(x)) \wedge \text{occurrence\_of}(o2, \text{Snap}(x)) \wedge \text{next\_subacc}(o1, o2)$

### 3 Visual

$(\forall o) \text{occurrence\_of}(o, \text{Recipe1}) \supset (\exists o1, o2, o3, o4, o5, o6, o7, o8, o9, o10, o11, o12, o13, o14, o15, o16, o17, o18, o19) \wedge \text{occurrence\_of}(o1, \text{Step1}(x)) \wedge \text{occurrence\_of}(o2, \text{Step2}(x)) \wedge \text{occurrence\_of}(o3, \text{Step3}(x)) \wedge \text{occurrence\_of}(o4, \text{Step4}(x)) \wedge \text{occurrence\_of}(o5, \text{Step5}(x)) \wedge \text{occurrence\_of}(o5, \text{Step6}(x)) \wedge \text{occurrence\_of}(o3, \text{Step7}(x)) \wedge \text{occurrence\_of}(o4, \text{Step8}(x)) \wedge \text{occurrence\_of}(o5, \text{Step9}(x)) \wedge \text{occurrence\_of}(o5, \text{Step10}(x)) \wedge \text{occurrence\_of}(o1, \text{Step11}(x)) \wedge \text{occurrence\_of}(o2, \text{Step12}(x)) \wedge \text{occurrence\_of}(o3, \text{Step13}(x)) \wedge \text{occurrence\_of}(o4, \text{Step14}(x)) \wedge \text{occurrence\_of}(o5, \text{Step15}(x)) \wedge \text{occurrence\_of}(o5, \text{Step16}(x)) \wedge \text{occurrence\_of}(o3, \text{Step17}(x)) \wedge \text{occurrence\_of}(o4, \text{Step18}(x)) \wedge \text{occurrence\_of}(o5, \text{Step19}(x)) \wedge \text{next\_subacc}(o1, o2) \wedge \text{next\_subacc}(o2, o3) \wedge \text{next\_subacc}(o3, o4) \wedge \text{next\_subacc}(o4, o5) \wedge \text{next\_subacc}(o5, o6) \wedge \text{next\_subacc}(o6, o7) \wedge \text{next\_subacc}(o7, o8) \wedge \text{next\_subacc}(o8, o9) \wedge \text{next\_subacc}(o9, o10) \wedge \text{next\_subacc}(o10, o11) \wedge \text{next\_subacc}(o11, o12) \wedge \text{next\_subacc}(o12, o13) \wedge \text{next\_subacc}(o13, o14) \wedge \text{next\_subacc}(o14, o15) \wedge \text{next\_subacc}(o15, o16) \wedge \text{next\_subacc}(o16, o17) \wedge \text{next\_subacc}(o17, o18) \wedge \text{next\_subacc}(o18, o19)$

$(\forall o) \text{occurrence\_of}(o, \text{Step1}) \supset (\exists o1, a) \wedge \text{add}(a) \wedge \text{occurrence\_of}(o1, a)$

$(\forall a) \text{add}(a) \wedge \text{occurrence\_of}(o1, a) \supset (\exists x1, x2, x3, x4, x5) \text{butter}(x1) \wedge \text{mustard}(x2) \wedge \text{spices}(x3) \wedge \text{hotsauce}(x4) \wedge \text{thyme}(x5)$

$(\forall o) \text{occurrence\_of}(o, \text{Step2}) \supset (\exists o1, o2) \wedge \text{occurrence\_of}(o1, \text{Seal}(x)) \wedge \text{occurrence\_of}(o2, \text{Mix}(x)) \wedge \text{next\_subacc}(o1, o2)$

$(\forall o) \text{occurrence\_of}(o, \text{Step3}) \supset (\exists o1, x) \wedge \text{occurrence\_of}(o1, \text{Add}(x))$

$(\forall o) \text{occurrence\_of}(o, \text{Step4}) \supset (\exists o1, o2) \wedge \text{occurrence\_of}(o1, \text{Seal}(x)) \wedge \text{occurrence\_of}(o2, \text{Mix}(x)) \wedge \text{next\_subacc}(o1, o2)$

$(\forall o) \text{occurrence\_of}(o, \text{Step5}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Refrigerate}(x))$

$(\forall b) \text{PlaceOn}(b) \wedge \text{occurrence\_of}(o1, b) \supset (\exists x1, x2) \wedge \text{chicken}(x1) \wedge \text{tray}(x2)$

$$(\forall o) \text{occurrence\_of}(o, \text{Step6}) \supset (\exists o1, o2, c) \wedge \text{occurrence\_of}(o1, \text{Remove}(x)) \wedge \text{PlaceOn}(b) \wedge \text{occurrence\_of}(o2, b) \wedge \text{next\_subacc}(o1, o2)$$

$$(\forall c) \text{PlaceIn}(c) \wedge \text{occurrence\_of}(o1, c) \supset (\exists x1, x2, x3) \wedge \text{chicken}(x1) \wedge \text{tray}(x2) \wedge \text{oven}(x3)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step7}) \supset (\exists o1, c) \wedge \text{PlaceIn}(c) \wedge \text{occurrence\_of}(o1, c)$$

$$(\forall d) \text{RemoveFrom}(d) \wedge \text{occurrence\_of}(o1, d) \supset (\exists x1, x2, x3) \wedge \text{chicken}(x1) \wedge \text{tray}(x2) \wedge \text{oven}(x3)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step8}) \supset (\exists o1, d) \wedge \text{RemoveFrom}(d) \wedge \text{occurrence\_of}(o1, d)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step9}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Heat}(x))$$

$$(\forall e) \text{PlaceIn}(e) \wedge \text{occurrence\_of}(o1, e) \supset (\exists x1, x2, x3, x4) \wedge \text{butter}(x1) \wedge \text{hotsauce}(x2) \wedge \text{chicken}(x3) \wedge \text{bag}(x4)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step10}) \supset (\exists o1, e) \wedge \text{PlaceIn}(e) \wedge \text{occurrence\_of}(o1, e)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step11}) \supset (\exists o1, o2) \wedge \text{occurrence\_of}(o1, \text{Seal}(x)) \wedge \text{occurrence\_of}(o2, \text{Mix}(x)) \wedge \text{next\_subacc}(o1, o2)$$

$$(\forall f) \text{Add}(f) \wedge \text{occurrence\_of}(o1, f) \supset (\exists x1, x2, x3, x4, x5) \wedge \text{flour}(x1) \wedge \text{garlicpowder}(x2) \wedge \text{drymustard}(x3) \wedge \text{paprika}(x4) \wedge \text{spices}(x5)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step12}) \supset (\exists o1, o2, f) \wedge \text{Add}(f) \wedge \text{occurrence\_of}(o1, f) \wedge \text{occurrence\_of}(o2, \text{Stir}(x)) \wedge \text{next\_subacc}(o1, o2)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step13}) \supset (\exists o1, o2) \wedge \text{occurrence\_of}(o1, \text{Add}(x)) \wedge \text{occurrence\_of}(o2, \text{Remove}(x)) \wedge \text{next\_subacc}(o1, o2)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step14}) \supset (\exists o1, o2) \wedge \text{occurrence\_of}(o1, \text{Mix}(x)) \wedge \text{occurrence\_of}(o2, \text{Place}(x)) \wedge \text{next\_subacc}(o1, o2)$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step15}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Flip}(x))$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step16}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Remove}(x))$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step17}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Drizzle}(x))$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step18}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Place}(x))$$

$$(\forall o) \text{occurrence\_of}(o, \text{Step19}) \supset (\exists o1) \wedge \text{occurrence\_of}(o1, \text{Drizzle}(x))$$