

Elaboration Tolerant Representation of Markov Decision Process via Decision-Theoretic Extension of Probabilistic Action Language $p\mathcal{BC}+$

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Abstract. We extend probabilistic action language $p\mathcal{BC}+$ with the notion of utility as in decision theory. The semantics of the extended $p\mathcal{BC}+$ can be defined as a shorthand notation for a decision-theoretic extension of the probabilistic answer set programming language LP^{MLN} . Alternatively, the semantics of $p\mathcal{BC}+$ can also be defined in terms of Markov Decision Process (MDP), which in turn allows for representing MDP in a succinct and elaboration tolerant way as well as to leverage an MDP solver to compute a $p\mathcal{BC}+$ action description. The idea led to the design of the system PBCPLUS2MDP, which can find an optimal policy of a $p\mathcal{BC}+$ action description using an MDP solver.

1 Introduction

Many problems in Artificial Intelligence is about how to choose actions that maximize the agent's utility. Since actions may also have stochastic effects, the main computational task is, rather than to find a sequence of actions that leads to a goal, to find an optimal policy, that states which actions to execute in each state to achieve the maximum expected utility.

While a few decades of research has produced several expressive action languages, such as \mathcal{A} [1], \mathcal{B} [2], \mathcal{C} [3], $\mathcal{C}+$ [4], \mathcal{BC} [5], and $\mathcal{BC}+$ [6], that are able to describe actions and their effects in a succinct and elaboration tolerant way, they are not equipped with constructs to represent stochastic actions and the utility of an agent. In this paper, we present an action language that overcomes the limitation. Our method is to extend probabilistic action language $p\mathcal{BC}+$ [7] with the concept of utility and define policy optimization problems in that language.

Following the way that $p\mathcal{BC}+$ is defined as a shorthand notation of probabilistic answer set programming language LP^{MLN} for describing a probabilistic transition system, we first define a decision-theoretic extension of LP^{MLN} , which we call $\text{DT-LP}^{\text{MLN}}$, by associating a utility measure to each soft stable model in addition to its already defined probability. Next, we define the extended $p\mathcal{BC}+$ as a shorthand notation for $\text{DT-LP}^{\text{MLN}}$. It turns out that the semantics of $p\mathcal{BC}+$ can also be directly defined in terms of Markov Decision Process (MDP), which in turn allows us to define MDP in a succinct and elaboration tolerant way. The result is theoretically interesting as it formally relates action languages to MDP despite their different origins, and furthermore justifies the semantics of the extended $p\mathcal{BC}+$ in terms of MDP. It is also computationally interesting because it allows for applying a number of algorithms developed for MDP to computing $p\mathcal{BC}+$ action descriptions. Based on this idea, we design the system PBCPLUS2MDP, which turns a $p\mathcal{BC}+$ action description into the

input language of an MDP solver, and leverage MDP solving to find an optimal policy for the $p\mathcal{BC}+$ action description.

The extended $p\mathcal{BC}+$ can thus be viewed as a high-level representation of MDP that allows for compact and elaboration-tolerant encodings of sequential decision problems. Compared to other MDP-based planning description languages, such as PPDDL [8] and RDDDL [9], it inherits the nonmonotonicity of stable model semantics to be able to compactly represent recursive definitions and indirect effects of actions, which can save the state space significantly. Section 5 contains such an example.

This paper is organized as follows. After Section 2 reviews preliminaries, Section 3 extends LP^{MLN} with the notion of utility, through which we define the extension of $p\mathcal{BC}+$ with utility in Section 4. Section 5 defines $p\mathcal{BC}+$ as a high-level representation language for MDP and presents the prototype system PBCPLUS2MDP. We discuss the related work in Section 6.

2 Preliminaries

Due to the space limit, the reviews are brief. We refer the reader to the technical note <http://peace.eas.asu.edu/joolee/papers/dt1pmln-tech.pdf>. The note also contains all proofs and experiments with the system PBCPLUS2MDP. of this paper for the complete reviews or original papers [10, 7].

2.1 Review: Language LP^{MLN}

An LP^{MLN} program is a finite set of weighted rules $w : R$ where R is a rule and w is a real number (in which case, the weighted rule is called *soft*) or α for denoting the infinite weight (in which case, the weighted rule is called *hard*). Throughout the paper, we assume that the language is propositional. Schematic variables can be introduced via grounding as standard in answer set programming.

For any LP^{MLN} program Π and any interpretation I , $\overline{\Pi}$ denotes the usual (unweighted) ASP program obtained from Π by dropping the weights, and Π_I denotes the set of $w : R$ in Π such that $I \models R$.

Given a ground LP^{MLN} program Π , $\text{SM}[\Pi]$ denotes the set

$$\{I \mid I \text{ is a (deterministic) stable model of } \Pi_I \text{ that satisfies all hard rules in } \Pi\}.$$

For any interpretation I , the weight of an interpretation I , denoted $W_\Pi(I)$, is defined as

$$W_\Pi(I) = \begin{cases} \exp\left(\sum_{w:R \in \Pi_I} w\right) & \text{if } I \in \text{SM}[\Pi]; \\ 0 & \text{otherwise,} \end{cases}$$

and the probability of I , denoted $P_\Pi(I)$, is defined as

$$P_\Pi(I) = \frac{W_\Pi(I)}{\sum_{J \in \text{SM}[\Pi]} W_\Pi(J)}.$$

Name	Form	Translation in LP^{MLN}
static law	caused F if G where F and G are fluent formulas	$i : F \leftarrow i : G$ ($i \in \{0, \dots, m\}$)
fluent dynamic law	caused F if G after H where F and G are fluent formulas, H is a formula, F does not contain statically determined constants and H does not contain initpf constants	$i+1 : F \leftarrow (i+1 : G) \wedge (i : H)$ ($i \in \{0, \dots, m-1\}$)
pf constant declaration	caused $c = \{v_1 : p_1, \dots, v_n : p_n\}$ where c is a pf constant with domain $\{v_1, \dots, v_n\}$, $0 < p_i < 1$ for each $i \in \{1, \dots, n\}$ and $\sum_{i \in \{1, \dots, n\}} p_i = 1$	For each $j \in \{1, \dots, n\}$: $\text{ln}(p_i) : (i : c) = v_j$ ($i \in \{0, \dots, m-1\}$)
initpf constant declaration	caused $c = \{v_1 : p_1, \dots, v_n : p_n\}$ where c is an initpf constant with domain $\{v_1, \dots, v_n\}$, $0 < p_i < 1$ for each $i \in \{1, \dots, n\}$	For each $j \in \{1, \dots, n\}$: $\text{ln}(p_i) : (0 : c) = v_j$
initial static law	initially F if G where F is a fluent constant and G is a formula that contains neither action constants nor pf constants	$\perp \leftarrow \neg(0 : F) \wedge 0 : G$

Fig. 1. Causal laws in $p\mathcal{BC}+$ and their translations into LP^{MLN}

2.2 Review: Action Language $p\mathcal{BC}+$

$p\mathcal{BC}+$ assumes that the propositional signature σ is constructed from “constants” and their “values.” A *constant* c is a symbol that is associated with a finite set $\text{Dom}(c)$, called the *domain*. The signature σ is constructed from a finite set of constants, consisting of atoms $c = v$ for every constant c and every element v in $\text{Dom}(c)$. If the domain of c is $\{\text{FALSE}, \text{TRUE}\}$, then we say that c is *Boolean*, and abbreviate $c = \text{TRUE}$ as c and $c = \text{FALSE}$ as $\sim c$.

There are four types of constants in $p\mathcal{BC}+$: *fluent constants*, *action constants*, *pf (probability fact) constants* and *initpf (initial probability fact) constants*. Fluent constants are further divided into *regular* and *statically determined*. The domain of every action constant is restricted to be Boolean. An *action description* is a finite set of *causal laws*, which describes how fluents depend on each other within a single time step and how their values change from one time step to another. The expressions (causal laws) in $p\mathcal{BC}+$ is listed in the first column of Figure 1. A *fluent formula* is a formula such that all constants occurring in it are fluent constants.

We use σ^{fl} , σ^{act} , σ^{pf} , and σ^{initpf} to denote the set of fluent constants, action constants, pf constants, and initpf constants, respectively. Given a nonnegative integer m as the maximum timestamp, for any signature σ' and any $i \in \{0, \dots, m\}$, we use $i : \sigma'$ to denote the set $\{i : A \mid A \in \sigma'\}$. By $i : F$ we denote the result of inserting $i :$ in front of every occurrence of every constant in formula F .

The semantics of a $p\mathcal{BC}+$ action description D is defined by a translation into an LP^{MLN} program $\text{Tr}(D, m) = D_{init} \cup D_m$. Below we describe the essential part of the translation that turns a $p\mathcal{BC}+$ description into an LP^{MLN} program. For the complete translation, we refer the reader to [7].

The signature σ_m of D_m consists of atoms of the form $i : c = v$ such that

- for each fluent constant c of D , $i \in \{0, \dots, m\}$ and $v \in \text{Dom}(c)$,
- for each action constant or pf constant c of D , $i \in \{0, \dots, m-1\}$ and $v \in \text{Dom}(c)$.

D_m contains LP^{MLN} rules obtained from static laws, fluent dynamic laws, and pf constant declarations as described in the third column of Figure 1, as well as $\{0 : c = v\}^{\text{ch}}$ for

every regular fluent constant c and every $v \in \text{Dom}(c)$, and

$$\{i:c = \text{TRUE}\}^{\text{ch}}, \{i:c = \text{FALSE}\}^{\text{ch}}$$

for every action constant c to state that the initial value of each fluent and actions are exogenous. D_{init} contains LP^{MLN} rules obtained from initial static laws and initpf constant declarations as described in the third column of Figure 1. Both D_m and D_{init} also contain constraints for asserting that each constant is mapped to exactly one value in its domain.

For any LP^{MLN} program Π of signature σ and a value assignment I to a subset σ' of σ , we say I is a *residual (probabilistic) stable model* of Π if there exists a value assignment J to $\sigma \setminus \sigma'$ such that $I \cup J$ is a (probabilistic) stable model of Π .

For any value assignment I to constants in σ , by $i:I$ we denote the value assignment to constants in $i:\sigma$ so that $i:I \models (i:c) = v$ iff $I \models c = v$. For $x \in \{\text{act}, \text{fl}, \text{pf}\}$, we use σ_m^x to denote the subset of σ_m : $\{i:c = v \mid i:c = v \in \sigma_m \text{ and } c \in \sigma^x\}$.

A *state* is an interpretation I^{fl} of σ^{fl} such that $0:I^{\text{fl}}$ is a residual (probabilistic) stable model of D_0 . A *transition* of D is a triple $\langle s, e, s' \rangle$ where s and s' are interpretations of σ^{fl} and e is an interpretation of σ^{act} such that $0:s \cup 0:e \cup 1:s'$ is a residual stable model of D_1 . A *pf-transition* of D is a pair $(\langle s, e, s' \rangle, \text{pf})$, where pf is a value assignment to σ^{pf} such that $0:s \cup 0:e \cup 1:s' \cup 0:\text{pf}$ is a stable model of D_1 .

The following simplifying assumptions are made on action descriptions in $p\mathcal{BC}+$.

1. **No Concurrency:** For all transitions $\langle s, e, s' \rangle$, we have $e(a) = \text{TRUE}$ for at most one $a \in \sigma^{\text{act}}$;
2. **Nondeterministic Transitions are Determined by pf constants:** For any state s , any value assignment e of σ^{act} , and any value assignment pf of σ^{pf} , there exists exactly one state s' such that $(\langle s, e, s' \rangle, \text{pf})$ is a pf-transition;
3. **Nondeterminism on Initial States are Determined by Initpf constants:** For any value assignment pf_{init} of σ^{initpf} , there exists exactly one assignment fl of σ^{fl} such that $0:\text{pf}_{\text{init}} \cup 0:\text{fl}$ is a stable model of $D_{\text{init}} \cup D_0$.

With the above three assumptions, the probability of a history, i.e., a sequence of states and actions, can be computed as the product of the probabilities of all the transitions that the history is composed of, multiplied by the probability of the initial state (Corollary 1 in [7]).

2.3 Review: Markov Decision Process

A *Markov Decision Process (MDP)* M is a tuple $\langle S, A, T, R \rangle$ where (i) S is a set of states; (ii) A is a set of actions; (iii) $T : S \times A \times S \rightarrow [0, 1]$ defines transition probabilities; (iv) $R : S \times A \times S \rightarrow \mathbb{R}$ is the reward function.

Finite Horizon Policy Optimization Given a nonnegative integer m as the maximum timestamp, and a history $\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle$ such that each $s_i \in S$ ($i \in \{0, \dots, m\}$) and each $a_i \in A$ ($i \in \{0, \dots, m-1\}$), the *total reward* of the history under MDP M is defined as

$$R_M(\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle) = \sum_{i=0}^{m-1} R(s_i, a_i, s_{i+1}).$$

The probability of $\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle$ under MDP M is defined as

$$P_M(\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle) = \prod_{i=0}^{m-1} T(s_i, a_i, s_{i+1}).$$

A *non-stationary policy* $\pi : S \times ST \mapsto A$ is a function from $S \times ST$ to A , where $ST = \{0, \dots, m-1\}$. Given an initial state s_0 , the *expected total reward* of a non-stationary policy π under MDP M is

$$\begin{aligned} ER_M(\pi, s_0) &= E_{\substack{\langle s_1, \dots, s_m \rangle: \\ s_i \in S \text{ for } i \in \{1, \dots, m\}}} [R_M(\langle s_0, \pi(s_0, 0), s_1, \dots, s_{m-1}, \pi(s_{m-1}, m-1), s_m \rangle)] \\ &= \sum_{\substack{\langle s_1, \dots, s_m \rangle: \\ s_i \in S \text{ for } i \in \{1, \dots, m\}}} \left(\sum_{i=0}^{m-1} R(s_i, \pi(s_i, i), s_{i+1}) \right) \times \left(\prod_{i=0}^{m-1} T(s_i, \pi(s_i, i), s_{i+1}) \right). \end{aligned}$$

The *finite horizon policy optimization* problem is to find a non-stationary policy π that maximizes its expected total reward, given an initial state s_0 , i.e., $\arg\max_{\pi} ER_M(\pi, s_0)$.

Infinite Horizon Policy Optimization Policy optimization with the infinite horizon is defined similar to the finite horizon, except that a discount rate for the reward is introduced, and the policy is stationary, i.e., no need to mention time steps (ST). Given an infinite sequence of states and actions $\langle s_0, a_0, s_1, a_1, \dots \rangle$, such that each $s_i \in S$ and each $a_i \in A$ ($i \in \{0, \dots\}$), and a discount factor $\gamma \in [0, 1]$, the *discounted total reward* of the sequence under MDP M is defined as

$$R_M(\langle s_0, a_0, s_1, a_1, \dots \rangle) = \sum_{i=0}^{\infty} \gamma^{i+1} R(s_i, a_i, s_{i+1}).$$

Various algorithms for MDP policy optimization have been developed, such as value iteration [11] for an exact solution, and Q-learning [12] for approximate solutions.

3 DT-LP^{MLN}

We extend the syntax and semantics of LP^{MLN} for DT-LP^{MLN} by introducing atoms of the form

$$\text{utility}(u, \mathbf{t}) \tag{1}$$

where u is a real number, and \mathbf{t} is an arbitrary list of terms. These atoms can only occur in the head of hard rules of the form

$$\alpha : \text{utility}(u, \mathbf{t}) \leftarrow \text{Body} \tag{2}$$

where *Body* is a list of literals. We call these rules *utility rules*.

The weight and the probability of an interpretation are defined the same as in LP^{MLN}. The *utility* of an interpretation I under Π is defined as

$$U_{\Pi}(I) = \sum_{\text{utility}(u, \mathbf{t}) \in I} u.$$

Given a proposition A , the *expected utility* of A is defined as

$$E[U_{\Pi}(A)] = \sum_{I \models A} U_{\Pi}(I) \times P_{\Pi}(I \mid A). \tag{3}$$

A DT-LP^{MLN} program is a pair $\langle \Pi, \text{Dec} \rangle$ where Π is an LP^{MLN} program with a propositional signature σ (including *utility* atoms) and *Dec* is a subset of σ consisting of *decision atoms*. We consider two reasoning tasks on DT-LP^{MLN}.

- **Evaluating a Decision.** Given a propositional formula e (“evidence”) and a truth assignment dec of decision atoms Dec , represented as a conjunction of literals over atoms in Dec , compute the expected utility of decision dec in the presence of evidence e , i.e., compute

$$E[U_{\Pi}(dec \wedge e)] = \sum_{I \models dec \wedge e} U_{\Pi}(I) \times P_{\Pi}(I \mid dec \wedge e).$$

- **Finding a Decision with Maximum Expected Utility (MEU).** Given a propositional formula e (“evidence”), find the truth assignment dec on Dec such that the expected utility of dec in the presence of e is maximized, i.e., compute

$$\operatorname{argmax}_{dec : dec \text{ is a truth assignment on } Dec} E[U_{\Pi}(dec \wedge e)]. \quad (4)$$

Example 1. Consider a directed graph G representing a social network: (i) each vertex $v \in V(G)$ represents a person; each edge (v_1, v_2) represents that v_1 influences v_2 ; (ii) each edge $e = (v_1, v_2)$ is associated with a probability p_e representing the probability of the influence; (iii) each vertex v is associated with a cost c_v , representing the cost of marketing the product to v ; (iv) each person who buys the product yields a reward of r .

The goal is to choose a subset U of vertices as marketing targets so as to maximize the expected profit. The problem can be represented as a DT-LP^{MLN} program Π^{market} as follows:

$$\begin{aligned} \alpha : \text{buy}(v) &\leftarrow \text{marketTo}(v). \\ \alpha : \text{buy}(v_2) &\leftarrow \text{buy}(v_1), \text{influence}(v_1, v_2). \\ \alpha : \text{utility}(r, v) &\leftarrow \text{buy}(v). \end{aligned}$$

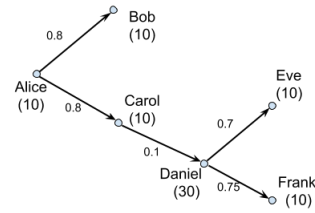
with the graph instance represented as follows:

- for each edge $e = (v_1, v_2)$, we introduce a probabilistic fact $\text{ln}(\frac{p_e}{1-p_e}) : \text{influence}(v_1, v_2)$;
- for each vertex $v \in V(G)$, we introduce the following rule:
 $\alpha : \text{utility}(-c_v, v) \leftarrow \text{marketTo}(v).$

For simplicity, we assume that marketing to a person 100% guarantees that the person buys the product. This assumption can be removed easily by changing the first rule to a soft rule.

The MEU solution of DT-LP^{MLN} program $(\Pi^{\text{market}}, \{\text{marketTo}(v) \mid v \in V(G)\})$ corresponds to the subset U of vertices that maximizes the expected profit.

For example, consider the directed graph on the right, where each edge e is labeled by p_e and each vertex v is labeled by c_v . Suppose the reward for each person buying the product is 10. There are $2^6 = 64$ different truth assignments on decision atoms, corresponding to 64 choices of marketing targets. The best decision is to market to Alice only, which yields the expected utility of 17.96.



4 $p\mathcal{BC}+$ with Utility

We extend $p\mathcal{BC}+$ by introducing the following expression called *utility law* that assigns a reward to transitions:

$$\text{reward } v \text{ if } F \text{ after } G \quad (5)$$

where v is a real number representing the reward, F is a formula that contains fluent constants only, and G is a formula that contains fluent constants and action constants only (no pf, no initpf constants). We extend the signature of $Tr(D, m)$ with a set of atoms of the form (1). We turn a utility law of the form (5) into the LP^{MLN} rule

$$\alpha : \text{utility}(v, i + 1, id) \leftarrow (i + 1 : F) \wedge (i : G) \quad (6)$$

where id is a unique number assigned to this (ground) LP^{MLN} rule and $i \in \{0, \dots, m-1\}$.

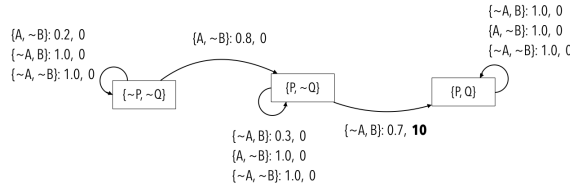
Given a nonnegative integer m denoting the maximum timestamp, a $pBC+$ action description D with utility over multi-valued propositional signature σ is defined as a high-level representation of the DT- LP^{MLN} program $(Tr(D, m), \sigma_m^{act})$.

We extend the definition of a probabilistic transition system as follows: A *probabilistic transition system* $T(D)$ represented by a probabilistic action description D is a labeled directed graph such that the vertices are the states of D , and the edges are obtained from the transitions of D : for every transition $\langle s, e, s' \rangle$ of D , an edge labeled $e : p, u$ goes from s to s' , where $p = Pr_{D_1}(1 : s' \mid 0 : s \wedge 0 : e)$ and $u = E[U_{D_1}(0 : s \wedge 0 : e \wedge 1 : s')]$. The number p is called the *transition probability* of $\langle s, e, s' \rangle$, denoted by $p(s, e, s')$, and the number u is called the *transition reward* of $\langle s, e, s' \rangle$, denoted by $u(s, e, s')$.

Example 2. The following action description D^{simple} describes a simple probabilistic action domain with two Boolean fluents P, Q , and two actions A and B . A causes P to be true with probability 0.8, and if P is true, then B causes Q to be true with probability 0.7. The agent receives the reward 10 if P and Q become true for the first time (after then, it remains in the state $\{P, Q\}$ as it is an absorbing state).

<p>A causes P if Pf_1 B causes Q if $P \wedge Pf_2$ inertial P, Q constraint $\neg(Q \wedge \sim P)$ caused $Pf_1 = \{\text{TRUE} : 0.8, \text{FALSE} : 0.2\}$ caused $Pf_2 = \{\text{TRUE} : 0.7, \text{FALSE} : 0.3\}$</p>	<p>reward 10 if $P \wedge Q$ after $\neg(P \wedge Q)$ caused $InitP = \{\text{TRUE} : 0.6, \text{FALSE} : 0.4\}$ initially $P = x$ if $InitP = x$ caused $InitQ = \{\text{TRUE} : 0.5, \text{FALSE} : 0.5\}$ initially Q if $InitQ \wedge P$ initially $\sim Q$ if $\sim P$.</p>
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The transition system $T(D^{simple})$ is as follows:



4.1 Policy Optimization

Given a $pBC+$ action description D , we use \mathbf{S} to denote the set of states, i.e., the set of interpretations I^{fl} of σ^{fl} such that $0 : I^{fl}$ is a residual (probabilistic) stable model of D_0 . We use \mathbf{A} to denote the set of interpretations I^{act} of σ^{act} such that $0 : I^{act}$ is a residual (probabilistic) stable model of D_1 . Since we assume at most one action is executed each time step, each element in \mathbf{A} makes either only one action or none to be true.

A (non-stationary) policy π (in $p\mathcal{BC}+$) is a function

$$\pi : \mathbf{S} \times \{0, \dots, m-1\} \mapsto \mathbf{A}$$

that maps a state and a time step to an action (including doing nothing). By $\langle s_0, s_1, \dots, s_m \rangle^t$ (each $s_i \in \mathbf{S}$) we denote the formula $0:s_0 \wedge 1:s_1 \cdots \wedge m:s_m$, and by $\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle^t$ (each $s_i \in \mathbf{S}$ and each $a_i \in \mathbf{A}$) the formula

$$0:s_0 \wedge 0:a_0 \wedge 1:s_1 \wedge \cdots \wedge m-1:a_{m-1} \wedge m:s_m.$$

For any $i \in \{0, \dots, m\}$ and $s \in \mathbf{S}$, we write $i:s$ as an abbreviation of the formula $\bigwedge_{fl \in \sigma^{fl}} i:fl$; for any $i \in \{0, \dots, m-1\}$ and $a \in \mathbf{A}$, we write $i:a$ as an abbreviation of the formula $\bigwedge_{act \in \sigma^{act}} i:act = a(act)$.

We say a state s is *consistent* with D_{init} if there exists at least one probabilistic stable model I of D_{init} such that $I \models 0:s$. The *Policy Optimization* problem is to find a policy π that maximizes the expected utility starting from s_0 , i.e., π with

$$\operatorname{argmax}_{\pi \text{ is a policy}} E[U_{Tr(D,m)}(C_{\pi,m} \cup \langle s_0 \rangle^t)]$$

where $C_{\pi,m}$ is the following formula representing policy π :

$$\bigwedge_{s \in \mathbf{S}, \pi(s,i)=a, i \in \{0, \dots, m\}} i:s \rightarrow i:a.$$

We define the *total reward* of a history $\langle s_0, a_0, s_1, \dots, s_m \rangle$ under action description D as

$$R_D(\langle s_0, a_0, s_1, \dots, s_m \rangle) = E[U_{Tr(D,m)}(\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle^t)].$$

Although it is defined as an expectation, the following proposition tells us that any stable model X of $Tr(D,m)$ such that $X \models \langle s_0, a_0, s_1, \dots, s_m \rangle$ has the same utility, and consequently, the expected utility of $\langle s_0, a_0, s_1, \dots, s_m \rangle$ is the same as the utility of any single stable model that satisfies the history.

Proposition 1 For any two stable models X_1, X_2 of $Tr(D,m)$ that satisfy a history $\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle$, we have

$$U_{Tr(D,m)}(X_1) = U_{Tr(D,m)}(X_2) = E[U_{Tr(D,m)}(\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle^t)].$$

It can be seen that the expected utility of π can be computed from the expected utility from all possible state sequences.

Proposition 2 Given any initial state s_0 that is consistent with D_{init} , for any non-stationary policy π , we have

$$E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] = \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) \times P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}).$$

Definition 1. For a $p\mathcal{BC}+$ action description D , let $M(D)$ be the MDP $\langle S, A, T, R \rangle$ where (i) the state set S is \mathbf{S} ; (ii) the action set A is \mathbf{A} ; (iii) transition probability T is defined as $T(s, a, s') = P_{D_1}(1:s' \mid 0:s \wedge 0:a)$; (iv) reward function R is defined as $R(s, a, s') = E[U_{D_1}(0:s \wedge 0:a \wedge 1:s')]$.

We show that the policy optimization problem for a $p\mathcal{BC}+$ action description D can be reduced to policy optimization problem for $M(D)$ for the finite horizon. The following theorem tells us that for any history following a non-stationary policy, its total reward and probability under D defined under the $p\mathcal{BC}+$ semantics coincide with those under the corresponding MDP $M(D)$.

Theorem 1 *Given an initial state $s_0 \in \mathbf{S}$ that is consistent with D_{init} , for any non-stationary policy π and any finite state sequence $\langle s_0, s_1, \dots, s_{m-1}, s_m \rangle$ such that each s_i in \mathbf{S} ($i \in \{0, \dots, m\}$), we have*

- $R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) = R_{M(D)}(\langle s_0, \pi(s_0), \dots, \pi(s_{m-1}), s_m \rangle)$
- $P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}) = P_{M(D)}(\langle s_0, \pi(s_0), \dots, \pi(s_{m-1}), s_m \rangle)$.

It follows that the policy optimization problem for $p\mathcal{BC}+$ action descriptions and the same problem for MDP with finite horizon coincide.

Theorem 2 *For any nonnegative integer m and an initial state $s_0 \in \mathbf{S}$ that is consistent with D_{init} , we have*

$$\operatorname{argmax}_{\pi \text{ is a non-stationary policy}} E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] = \operatorname{argmax}_{\pi \text{ is a non-stationary policy}} ER_{M(D)}(\pi, s_0).$$

Theorem 2 justifies using an implementation of DT-LP^{MLN} to compute optimal policies of MDP $M(D)$ as well as using an MDP solver to compute optimal policies of the $p\mathcal{BC}+$ descriptions. Furthermore the theorems above allow us to check the properties of MDP $M(D)$ by using formal properties of LP^{MLN}, such as whether a certain state is reachable in a given number of steps.

5 $p\mathcal{BC}+$ as a High-Level Representation Language of MDP

An action description consists of causal laws in a human-readable form describing the action domain in a compact and high-level way, whereas it is non-trivial to describe an MDP instance directly from the domain description in English. The result in the previous section shows how to construct an MDP instance $M(D)$ for a $p\mathcal{BC}+$ action description D so that the solution to the policy optimization problem of D coincide with that of MDP $M(D)$. In that sense, $p\mathcal{BC}+$ can be viewed as a high-level representation language for MDP.

As its semantics is defined in terms of LP^{MLN}, $p\mathcal{BC}+$ inherits the nonmonotonicity of the stable model semantics to be able to compactly represent recursive definitions or transitive closure. The static laws in $p\mathcal{BC}+$ can prune out invalid states to ensure that only meaningful value combinations of fluents will be given to MDP as states, thus reducing the size of state space at the MDP level.

We illustrate the advantage of using $p\mathcal{BC}+$ action descriptions as high-level representations of MDP with an example.

Example 3. Robot and Blocks *There are two rooms R1, R2, and three blocks B1, B2, B3 that are originally located in R1. A robot can stack one block on top of another block if the two blocks are in the same room. The robot can also move a block to a different room, resulting in all blocks on top of it also moving if successful (with probability p). Each moving action has a cost of 1. What is the best way to move all blocks to R2?*

The example can be represented in $p\mathcal{BC}+$ as follows. x, x_1, x_2 range over B1, B2, B3; r, r_1, r_2 ranges over R1, R2. $TopClear(x)$, $Above(x_1, x_2)$, and $GoalNotAchieved$ are Boolean statically determined fluent constants; $In(x)$ is a regular fluent constant with Domain $\{R1, R2\}$, and $OnTopOf(x_1, x_2)$ is a Boolean regular fluent constant. $MoveTo(x, r)$ and $StackOn(x_1, x_2)$ are action constants and Pf_Move is a Boolean pf constant. In this example, we make the goal state absorbing, i.e., when all the blocks are already in R2, then all actions have no effect.

Moving block x to room r causes x to be in r with probability p :

$$\begin{aligned} & MoveTo(x, r) \text{ causes } In(x) = r \text{ if } Pf_Move \wedge GoalNotAchieved \\ & \text{caused } Pf_Move = \{TRUE : p, FALSE : 1 - p\}. \end{aligned}$$

Successfully Moving a block x_1 to a room r_2 causes x_1 to be no longer underneath the block x_2 that x_1 was underneath in the previous step, if r_2 is different from where x_2 is:

$$\begin{aligned} & MoveTo(x_1, r_2) \text{ causes } \sim OnTopOf(x_1, x_2) \\ & \text{if } Pf_Move \wedge In(x_1) = r_1 \wedge OnTopOf(x_1, x_2) \wedge GoalNotAchieved \quad (r_1 \neq r_2). \end{aligned}$$

Stacking a block x_1 on another block x_2 causes x_1 to be on top of x_2 , if the top of x_2 is clear, and x_1 and x_2 are at the same location:

$$\begin{aligned} & StackOn(x_1, x_2) \text{ causes } OnTopOf(x_1, x_2) \\ & \text{if } TopClear(x_2) \wedge At(x_1) = r \wedge At(x_2) = r \wedge GoalNotAchieved \quad (x_1 \neq x_2). \end{aligned}$$

Stacking a block x_1 on another block x_2 causes x_1 to be no longer on top of the block x where x_1 was originally on top of:

$$\begin{aligned} & StackOn(x_1, x_2) \text{ causes } \sim OnTopOf(x_1, x) \text{ if } TopClear(x_2) \wedge At(x_1) = r \wedge At(x_2) = r \wedge \\ & OnTopOf(x_1, x) \wedge GoalNotAchieved \quad (x_2 \neq x, x_1 \neq x_2). \end{aligned}$$

Two different blocks cannot be on top of the same block, and a block cannot be on top of two different blocks:

$$\begin{aligned} & \text{constraint } \neg(OnTopOf(x_1, x) \wedge OnTopOf(x_2, x)) \quad (x_1 \neq x_2) \\ & \text{constraint } \neg(OnTopOf(x, x_1) \wedge OnTopOf(x, x_2)) \quad (x_1 \neq x_2). \end{aligned}$$

By default, the top of a block x is clear. It is not clear if there is another block x_1 that is on top of it:

$$\begin{aligned} & \text{default } TopClear(x) \\ & \text{caused } \sim TopClear(x) \text{ if } OnTopOf(x_1, x). \end{aligned}$$

The relation *Above* between two blocks is the transitive closure of the relation *OnTopOf*: A block x_1 is above another block x_2 if x_1 is on top of x_2 , or there is another block x such that x_1 is above x and x is above x_2 :

$$\begin{aligned} & \text{caused } Above(x_1, x_2) \text{ if } OnTopOf(x_1, x_2) \\ & \text{caused } Above(x_1, x_2) \text{ if } Above(x_1, x) \wedge Above(x, x_2). \end{aligned}$$

One block cannot be above itself; Two blocks cannot be above each other:

$$\text{caused } \perp \text{ if } Above(x_1, x_2) \wedge Above(x_2, x_1).$$

If a block x_1 is above another block x_2 , then x_1 has the same location as x_2 :

$$\mathbf{caused} \text{ } At(x_1) = r \text{ if } Above(x_1, x_2) \wedge At(x_2) = r. \quad (7)$$

Each moving action has a cost of 1:

$$\mathbf{reward} - 1 \text{ if } \top \text{ after } MoveTo(x, r).$$

Achieving the goal when the goal is not previously achieved yields a reward of 10:

$$\mathbf{reward} 10 \text{ if } \sim GoalNotAchieved \text{ after } GoalNotAchieved.$$

The goal is not achieved if there exists a block x that is not at R2. It is achieved otherwise:

$$\begin{aligned} &\mathbf{caused} \text{ } GoalNotAchieved \text{ if } At(x) = r \text{ } (r \neq L2) \\ &\mathbf{default} \text{ } \sim GoalNotAchieved. \end{aligned}$$

$At(x)$ and $OnTopOf(x_1, x_2)$ are inertial:

$$\mathbf{inertial} \text{ } At(x), OnTopOf(x_1, x_2).$$

Finally, we add $a_1 \wedge a_2 \mathbf{causes} \perp$ for each distinct pair of ground action constants a_1 and a_2 , to ensure that at most one action can occur each time step.

It can be seen that stacking all blocks together and moving them at once would be the best strategy to move them to L2.

In Example 3, many value combinations of fluents do not lead to a valid state, such as

$$\{OnTopOf(B1, B2), OnTopOf(B2, B1), \dots\}$$

where the two blocks B1 and B2 are on top of each other. Moreover, the fluents $TopClear(x)$ and $Above(x_1, x_2)$ are completely dependent on the value of the other fluents. There would be $2^{3+3+3+3+3+3} = 2^{24}$ states if we define a state as any value combination of fluents. On the other hand, the static laws in the above action descriptions reduce the number of states to only $(13 + 9) \times 2 = 44$.¹

Furthermore, in this example, $Above(x, y)$ needs to be defined as a transitive closure of $OnTopOf(x, y)$, so that the effects of $StackOn(x_1, x_2)$ can be defined in terms of the (inferred) spatial relation of blocks. Also, the static law (7) defines an indirect effect of $MoveTo(x, r)$.

We implemented the prototype system PBCPLUS2MDP, which takes an action description D and time horizon m as input, and finds an optimal policy by constructing the corresponding MDP $M(D)$ and utilizing MDP policy optimization algorithms as blackbox. We use MDPTOOLBOX² as our underlying MDP solver. The current system uses LP^{MLN} 1.0 [13] (<http://reasoning.eas.asu.edu/lpmln>) for exact inference to find states, actions, transition probabilities, and transition rewards. The system is publicly available at <https://github.com/ywang485/pbcplus2mdp>, along with several examples.

¹ This number can be verified by counting all possible configurations of 3 blocks with 2 locations.

² <https://pymdptoolbox.readthedocs.io>

6 Related Work

There have been quite a few studies and attempts in defining factored representations of (PO)MDP, with feature-based state descriptions and more compact, human-readable action definitions. PPDDL [8] extends PDDL with constructs for describing probabilistic effects of actions and reward from state transitions. One limitation of PPDDL is the lack of static causal laws, which prohibits PPDDL from expressing recursive definitions or transitive closure. This may yield a large state space to explore as discussed in Section 5.

RDDL (Relational Dynamic Influence Diagram Language) [9] improves the expressivity of PPDDL in modeling stochastic planning domains by allowing concurrent actions, continuous values of fluents, state constraints, etc. The semantics is defined in terms of lifted dynamic Bayes network extended with influence graph. A lifted planner can utilize the first-order representation and potentially achieve better performance. Still, indirect effects are hard to be represented in RDDL.

Zhang *et al.* [14] adopt ASP and P-Log [15] to perform high-level symbolic reasoning, which, respectively produce a refined set of states and a refined probability distribution over states that are then fed to POMDP solvers for low-level planning. The refined sets of states and probability distribution over states take into account commonsense knowledge about the domain, and thus improves the quality of a plan and reduces computation needed at the POMDP level. Yang *et al.* [16] adopts the (deterministic) action description language \mathcal{BC} for high-level representations of the action domain, which defines high-level actions that can be treated as deterministic. Each action in the generated high-level plan is then mapped into more detailed low-level policies, which takes in stochastic effects of low-level actions into account.

Another related work is [17], which combines ASP and reinforcement learning by using action language $\mathcal{BC}+$ as a meta-level description of MDP. The $\mathcal{BC}+$ action descriptions define non-stationary MDPs in the sense that the states and actions can change with new situations occurring in the environment. The algorithm ASP(RL) proposed in this work iteratively calls ASP solver to obtain states and actions for the RL methods to learn transition probabilities and rewards, and update the $\mathcal{BC}+$ action description with changes in the environment found by the RL methods, in this way finding optimal policy for a non-stationary MDP with the search space reduced by ASP. The work is similar to ours in that ASP-based high-level logical description is used to generate states and actions for MDP, but the difference is that we use an extension of $\mathcal{BC}+$ that expresses transition probabilities and rewards.

7 Conclusion

Our main contributions are as follows.

- We presented a decision-theoretic extension of LP^{MLN} , through which we extend $p\mathcal{BC}+$ with the language constructs for representing reward of transitions;
- We showed that the semantics of $p\mathcal{BC}+$ can be equivalently defined in terms of the decision-theoretic LP^{MLN} or MDP;
- We presented the system PBCPLUS2MDP, which solves $p\mathcal{BC}+$ policy optimization problems with an MDP solver.

Formally relating action languages and MDP opens up an interesting research direction. Dynamic programming methods in MDP can be utilized to compute action languages. In turn, action languages may serve as a formal verification tool for MDP. Action languages may serve as a high-level representation language for MDP that describes an MDP instance

in a succinct and elaboration tolerant way. As many reinforcement learning task uses MDP as a modeling language, the work may be related to incorporating symbolic knowledge to reinforcement learning as evidenced by [14, 16].

DT-LP^{MLN} may deserve attention on its own for static domains. We are currently working on an implementation that extends LP^{MLN} system to handle utility. We expect that the system can be a useful tool for verifying properties for MDP.

The theoretical results in this paper limit attention to MDP for the finite horizon case. When the maximum step m is sufficiently large, we may view it as an approximation of the infinite horizon case, in which case, we allow discount factor γ by replacing v in (6) with $\gamma^{i+1}v$. While it appears intuitive to extend the theoretical results in this paper to the infinite case, it requires extending the definition of LP^{MLN} to allow infinitely many rules, which we leave for future work.

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³ <http://www.ep.liu.se/ea/cis/1998/016/>

Appendix to: Elaboration Tolerant Representation of Markov Decision Process via Decision Theoretic Extension of LP^{MLN}

A Extended Review of Preliminaries

A.1 Review: Language LP^{MLN}

An LP^{MLN} program is a finite set of weighted rules $w : R$ where R is a rule and w is a real number (in which case, the weighted rule is called *soft*) or α for denoting the infinite weight (in which case, the weighted rule is called *hard*). Throughout the paper, we assume that the language is propositional. Schematic variables can be introduced via grounding as standard in answer set programming.

For any LP^{MLN} program Π and any interpretation I , $\overline{\Pi}$ denotes the usual (unweighted) ASP program obtained from Π by dropping the weights, and Π_I denotes the set of $w : R$ in Π such that $I \models R$.

In general, an LP^{MLN} program may even have stable models that violate some hard rules, which encode definite knowledge. However, throughout the paper, we restrict attention to LP^{MLN} programs whose stable models do not violate hard rules. More precisely, given a ground LP^{MLN} program Π , $\text{SM}[\Pi]$ denotes the set

$$\{I \mid I \text{ is a (deterministic) stable model of } \Pi_I \text{ that satisfies all hard rules in } \Pi\}.$$

The weight of an interpretation I , denoted $W_\Pi(I)$, is defined as

$$W_\Pi(I) = \begin{cases} \exp\left(\sum_{w:R \in \Pi_I} w\right) & \text{if } I \in \text{SM}[\Pi]; \\ 0 & \text{otherwise,} \end{cases}$$

and the probability of I , denoted $P_\Pi(I)$, is defined as

$$P_\Pi(I) = \frac{W_\Pi(I)}{\sum_{J \in \text{SM}[\Pi]} W_\Pi(J)}.$$

A.2 Review: Multi-Valued Probabilistic Programs

Multi-valued probabilistic programs [10] are a simple fragment of LP^{MLN} that allows us to represent probability more naturally.

We assume that the propositional signature σ is constructed from “constants” and their “values.” A *constant* c is a symbol that is associated with a finite set $\text{Dom}(c)$, called the *domain*. The signature σ is constructed from a finite set of constants, consisting of atoms $c = v$ ⁴ for every constant c and every element v in $\text{Dom}(c)$. If the domain of c is $\{\text{FALSE}, \text{TRUE}\}$ then we say that c is *Boolean*, and abbreviate $c = \text{TRUE}$ as c and $c = \text{FALSE}$ as $\sim c$.

We assume that constants are divided into *probabilistic* constants and *non-probabilistic* constants. A multi-valued probabilistic program Π is a tuple $\langle PF, \Pi \rangle$, where

⁴ Note that here “=” is just a part of the symbol for propositional atoms, and is not equality in first-order logic.

- PF contains *probabilistic constant declarations* of the following form:

$$p_1 :: c = v_1 \mid \dots \mid p_n :: c = v_n \quad (8)$$

one for each probabilistic constant c , where $\{v_1, \dots, v_n\} = \text{Dom}(c)$, $v_i \neq v_j$, $0 \leq p_1, \dots, p_n \leq 1$ and $\sum_{i=1}^n p_i = 1$. We use $M_{\Pi}(c = v_i)$ to denote p_i . In other words, PF describes the probability distribution over each “random variable” c .

- Π is a set of rules such that the head contains no probabilistic constants.

The semantics of such a program Π is defined as a shorthand for LP^{MLN} program $T(\Pi)$ of the same signature as follows.

- For each probabilistic constant declaration (8), $T(\Pi)$ contains, for each $i = 1, \dots, n$,
 (i) $\text{ln}(p_i) : c = v_i$ if $0 < p_i < 1$; (ii) $\alpha : c = v_i$ if $p_i = 1$; (iii) $\alpha : \perp \leftarrow c = v_i$ if $p_i = 0$.
 – For each rule $\text{Head} \leftarrow \text{Body}$ in Π , $T(\Pi)$ contains $\alpha : \text{Head} \leftarrow \text{Body}$.
 – For each constant c , $T(\Pi)$ contains the uniqueness of value constraints

$$\alpha : \perp \leftarrow c = v_1 \wedge c = v_2 \quad (9)$$

for all $v_1, v_2 \in \text{Dom}(c)$ such that $v_1 \neq v_2$, and the existence of value constraint

$$\alpha : \perp \leftarrow \neg \bigvee_{v \in \text{Dom}(c)} c = v. \quad (10)$$

In the presence of the constraints (9) and (10), assuming $T(\Pi)$ has at least one (probabilistic) stable model that satisfies all the hard rules, a (probabilistic) stable model I satisfies $c = v$ for exactly one value v , so we may identify I with the value assignment that assigns v to c .

A.3 Review: Action Language $p\mathcal{BC}+$

Syntax of $p\mathcal{BC}+$ We assume a propositional signature σ as defined in Section A.2. We further assume that the signature of an action description is divided into four groups: *fluent constants*, *action constants*, *pf (probability fact) constants* and *initpf (initial probability fact) constants*. Fluent constants are further divided into *regular* and *statically determined*. The domain of every action constant is Boolean. A *fluent formula* is a formula such that all constants occurring in it are fluent constants.

The following definition of $p\mathcal{BC}+$ is based on the definition of $\mathcal{BC}+$ language from [?].

A *static law* is an expression of the form

$$\mathbf{caused} \ F \ \mathbf{if} \ G \quad (11)$$

where F and G are fluent formulas.

A *fluent dynamic law* is an expression of the form

$$\mathbf{caused} \ F \ \mathbf{if} \ G \ \mathbf{after} \ H \quad (12)$$

where F and G are fluent formulas and H is a formula, provided that F does not contain statically determined constants and H does not contain initpf constants.

A *pf constant declaration* is an expression of the form

$$\mathbf{caused} \ c = \{v_1 : p_1, \dots, v_n : p_n\} \quad (13)$$

where c is a pf constant with domain $\{v_1, \dots, v_n\}$, $0 < p_i < 1$ for each $i \in \{1, \dots, n\}$ ⁵, and $p_1 + \dots + p_n = 1$. In other words, (13) describes the probability distribution of c .

An *initpf constant declaration* is an expression of the form (13) where c is an initpf constant.

An *initial static law* is an expression of the form

$$\text{initially } F \text{ if } G \quad (14)$$

where F is a fluent constant and G is a formula that contains neither action constants nor pf constants.

A *causal law* is a static law, a fluent dynamic law, a pf constant declaration, an initpf constant declaration, or an initial static law. An *action description* is a finite set of causal laws.

We use σ^{fl} to denote the set of fluent constants, σ^{act} to denote the set of action constants, σ^{pf} to denote the set of pf constants, and σ^{initpf} to denote the set of initpf constants. For any signature σ' and any $i \in \{0, \dots, m\}$, we use $i : \sigma'$ to denote the set $\{i : a \mid a \in \sigma'\}$.

By $i : F$ we denote the result of inserting $i :$ in front of every occurrence of every constant in formula F . This notation is straightforwardly extended when F is a set of formulas.

Semantics of $p\mathcal{BC}+$ Given a non-negative integer m denoting the maximum length of histories, the semantics of an action description D in $p\mathcal{BC}+$ is defined by a reduction to multi-valued probabilistic program $Tr(D, m)$, which is the union of two subprograms D_m and D_{init} as defined below.

For an action description D of a signature σ , we define a sequence of multi-valued probabilistic program D_0, D_1, \dots , so that the stable models of D_m can be identified with the paths in the transition system described by D .

The signature σ_m of D_m consists of atoms of the form $i : c = v$ such that

- for each fluent constant c of D , $i \in \{0, \dots, m\}$ and $v \in Dom(c)$,
- for each action constant or pf constant c of D , $i \in \{0, \dots, m-1\}$ and $v \in Dom(c)$.

For $x \in \{act, fl, pf\}$, we use σ_m^x to denote the subset of σ_m

$$\{i : c = v \mid i : c = v \in \sigma_m \text{ and } c \in \sigma^x\}.$$

For $i \in \{0, \dots, m\}$, we use $i : \sigma^x$ to denote the subset of σ_m^x

$$\{i : c = v \mid i : c = v \in \sigma_m^x\}.$$

We define D_m to be the multi-valued probabilistic program $\langle PF, \Pi \rangle$, where Π is the conjunction of

$$i : F \leftarrow i : G \quad (15)$$

for every static law (11) in D and every $i \in \{0, \dots, m\}$,

⁵ We require $0 < p_i < 1$ for each $i \in \{1, \dots, n\}$ for the sake of simplicity. On the other hand, if $p_i = 0$ or $p_i = 1$ for some i , that means either v_i can be removed from the domain of c or there is not really a need to introduce c as a pf constant. So this assumption does not really sacrifice expressivity.

$$i+1 : F \leftarrow (i+1 : G) \wedge (i : H) \quad (16)$$

for every fluent dynamic law (12) in D and every $i \in \{0, \dots, m-1\}$,

$$\{0 : c = v\}^{\text{ch}} \quad (17)$$

for every regular fluent constant c and every $v \in \text{Dom}(c)$,

$$\{i : c = \text{TRUE}\}^{\text{ch}}, \quad \{i : c = \text{FALSE}\}^{\text{ch}} \quad (18)$$

for every action constant c ,
and PF consists of

$$p_1 :: i : pf = v_1 \mid \dots \mid p_n :: i : pf = v_n \quad (19)$$

($i = 0, \dots, m-1$) for each pf constant declaration (13) in D that describes the probability distribution of pf .

In addition, we define the program D_{init} , whose signature is $0 : \sigma^{\text{init}pf} \cup 0 : \sigma^{\text{fl}}$. D_{init} is the multi-valued probabilistic program

$$D_{\text{init}} = \langle PF^{\text{init}}, \Pi^{\text{init}} \rangle$$

where Π^{init} consists of the rule

$$\perp \leftarrow \neg(0 : F) \wedge 0 : G$$

for each initial static law (14), and PF^{init} consists of

$$p_1 :: 0 : pf = v_1 \mid \dots \mid p_n :: 0 : pf = v_n$$

for each initpf constant declaration (13).

We define $\text{Tr}(D, m)$ to be the union of the two multi-valued probabilistic program $\langle PF \cup PF^{\text{init}}, \Pi \cup \Pi^{\text{init}} \rangle$.

For any LP^{MLN} program Π of signature σ and a value assignment I to a subset σ' of σ , we say I is a *residual (probabilistic) stable model* of Π if there exists a value assignment J to $\sigma \setminus \sigma'$ such that $I \cup J$ is a (probabilistic) stable model of Π .

For any value assignment I to constants in σ , by $i : I$ we denote the value assignment to constants in $i : \sigma$ so that $i : I \models (i : c) = v$ iff $I \models c = v$.

We define a *state* as an interpretation I^{fl} of σ^{fl} such that $0 : I^{\text{fl}}$ is a residual (probabilistic) stable model of D_0 . A *transition* of D is a triple $\langle s, e, s' \rangle$ where s and s' are interpretations of σ^{fl} and e is an interpretation of σ^{act} such that $0 : s \cup 0 : e \cup 1 : s'$ is a residual stable model of D_1 . A *pf-transition* of D is a pair $(\langle s, e, s' \rangle, pf)$, where pf is a value assignment to σ^{pf} such that $0 : s \cup 0 : e \cup 1 : s' \cup 0 : pf$ is a stable model of D_1 .

A *probabilistic transition system* $T(D)$ represented by a probabilistic action description D is a labeled directed graph such that the vertices are the states of D , and the edges are obtained from the transitions of D : for every transition $\langle s, e, s' \rangle$ of D , an edge labeled $e : p$ goes from s to s' , where $p = \text{Pr}_{D_m}(1 : s' \mid 0 : s, 0 : e)$. The number p is called the *transition probability* of $\langle s, e, s' \rangle$.

The soundness of the definition of a probabilistic transition system relies on the following proposition.

Proposition 3 For any transition $\langle s, e, s' \rangle$, s and s' are states.

We make the following simplifying assumptions on action descriptions:

1. **No Concurrency:** For all transitions $\langle s, e, s' \rangle$, we have $e(a) = t$ for at most one $a \in \sigma^{act}$;
2. **Nondeterministic Transitions are Controlled by pf constants:** For any state s , any value assignment e of σ^{act} such that at most one action is true, and any value assignment pf of σ^{pf} , there exists exactly one state s' such that $(\langle s, e, s' \rangle, pf)$ is a pf-transition;
3. **Nondeterminism on Initial States are Controlled by Initpf constants:** Given any assignment pf_{init} of σ^{initpf} , there exists exactly one assignment fl of σ^{fl} such that $0:pf_{init} \cup 0:fl$ is a stable model of $D_{init} \cup D_0$.

For any state s , any value assignment e of σ^{act} such that at most one action is true, and any value assignment pf of σ^{pf} , we use $\phi(s, e, pf)$ to denote the state s' such that $(\langle s, e, s' \rangle, pf)$ is a pf-transition (According to Assumption 2, such s' must be unique). For any interpretation I , $i \in \{0, \dots, m\}$ and any subset σ' of σ , we use $I|_{i:\sigma'}$ to denote the value assignment of I to atoms in $i : \sigma'$. Given any value assignment TC of $0:\sigma^{initpf} \cup \sigma_m^{pf}$ and a value assignment A of σ_m^{act} , we construct an interpretation $I_{TC \cup A}$ of $Tr(D, m)$ that satisfies $TC \cup A$ as follows:

- For all atoms p in $\sigma_m^{pf} \cup 0:\sigma^{initpf}$, we have $I_{TC \cup A}(p) = TC(p)$;
- For all atoms p in σ_m^{act} , we have $I_{TC \cup A}(p) = A(p)$;
- $(I_{TC \cup A})|_{0:\sigma^{fl}}$ is the assignment such that $(I_{TC \cup A})|_{0:\sigma^{fl} \cup 0:\sigma^{initpf}}$ is a stable model of $D_{init} \cup D_0$.
- For each $i \in \{1, \dots, m\}$,

$$(I_{TC \cup A})|_{i:\sigma^{fl}} = \phi((I_{TC \cup A})|_{(i-1):\sigma^{fl}}, (I_{TC \cup A})|_{(i-1):\sigma^{act}}, (I_{TC \cup A})|_{(i-1):\sigma^{pf}}).$$

By Assumptions 2 and 3, the above construction produces a unique interpretation.

It can be seen that in the multi-valued probabilistic program $Tr(D, m)$ translated from D , the probabilistic constants are $0:\sigma^{initpf} \cup \sigma_m^{pf}$. We thus call the value assignment of an interpretation I on $0:\sigma^{initpf} \cup \sigma_m^{pf}$ the *total choice* of I . The following theorem asserts that the probability of a stable model under $Tr(D, m)$ can be computed by simply dividing the probability of the total choice associated with the stable model by the number of choice of actions.

Theorem 3 For any value assignment TC of $0:\sigma^{initpf} \cup \sigma_m^{pf}$ and any value assignment A of σ_m^{act} , there exists exactly one stable model $I_{TC \cup A}$ of $Tr(D, m)$ that satisfies $TC \cup A$, and the probability of $I_{TC \cup A}$ is

$$Pr_{Tr(D, m)}(I_{TC \cup A}) = \frac{\prod_{c=v \in TC} M(c=v)}{(|\sigma^{act}| + 1)^m}.$$

The following theorem tells us that the conditional probability of transiting from a state s to another state s' with action e remains the same for all timesteps, i.e., the conditional probability of $i+1 : s'$ given $i : s$ and $i : e$ correctly represents the transition probability from s to s' via e in the transition system.

Theorem 4 For any state s and s' , and action e , we have

$$Pr_{Tr(D,m)}(i+1:s' \mid i:s, i:e) = Pr_{Tr(D,m)}(j+1:s' \mid j:s, j:e)$$

for any $i, j \in \{0, \dots, m-1\}$ such that $Pr_{Tr(D,m)}(i:s) > 0$ and $Pr_{Tr(D,m)}(j:s) > 0$.

For every subset X_m of $\sigma_m \setminus \sigma_m^{pf}$, let $X^i (i < m)$ be the triple consisting of

- the set consisting of atoms A such that $i:A$ belongs to X_m and $A \in \sigma^{fl}$;
- the set consisting of atoms A such that $i:A$ belongs to X_m and $A \in \sigma^{act}$;
- the set consisting of atoms A such that $i+1:A$ belongs to X_m and $A \in \sigma^{fl}$.

Let $p(X^i)$ be the transition probability of X^i , s_0 is the interpretation of σ_0^{fl} defined by X^0 , and e_i be the interpretations of $i:\sigma^{act}$ defined by X^i .

Since the transition probability remains the same, the probability of a path given a sequence of actions can be computed from the probabilities of transitions.

Corollary 1 For every $m \geq 1$, X_m is a residual (probabilistic) stable model of $Tr(D, m)$ iff X^0, \dots, X^{m-1} are transitions of D and $0:s_0$ is a residual stable model of D_{init} . Furthermore,

$$Pr_{Tr(D,m)}(X_m \mid 0:e_0, \dots, m-1:e_{m-1}) = p(X^0) \times \dots \times p(X^m) \times Pr_{Tr(D,m)}(0:s_0).$$

A.4 Review: Markov Decision Process

A *Markov Decision Process (MDP)* M is a tuple $\langle S, A, T, R \rangle$ where (i) S is a set of states; (ii) A is a set of actions; (iii) $T : S \times A \times S \rightarrow [0, 1]$ defines transition probabilities; (iv) $R : S \times A \times S \rightarrow \mathbb{R}$ is the reward function.

Finite Horizon Policy Optimization Given a non-negative integer m as the maximum timestep, and a history $\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle$ such that each $s_i \in S (i \in \{0, \dots, m\})$ and each $a_i \in A (i \in \{0, \dots, m-1\})$, the *total reward* of the sequence under MDP M is defined as

$$TR_M(\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle) = \sum_{i=0}^{m-1} R(s_i, a_i, s_{i+1}).$$

The probability of $s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m$ under MDP M is defined as

$$P_M(\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle) = \prod_{i=0}^{m-1} T(s_i, a_i, s_{i+1})$$

A *non-stationary policy* $\pi : S \times ST \rightarrow A$ is a function from $S \times ST$ to A , where $ST = \{0, \dots, m-1\}$. Given an initial state s_0 , the *expected total reward* of a non-stationary policy π under MDP M is

$$\begin{aligned} ER_M(\pi, s_0) &= \sum_{\substack{\langle s_1, \dots, s_m \rangle: \\ s_i \in S \text{ for } i \in \{1, \dots, m\}}} E [TR_M(\langle s_0, \pi(s_0, 0), s_1, \dots, s_{m-1}, \pi(s_{m-1}, m-1), s_m \rangle)] \\ &= \sum_{\substack{\langle s_1, \dots, s_m \rangle: \\ s_i \in S \text{ for } i \in \{1, \dots, m\}}} \left(\sum_{i=0}^{m-1} R(s_i, \pi(s_i, i), s_{i+1}) \right) \cdot \left(\prod_{i=0}^{m-1} T(s_i, \pi(s_i, i), s_{i+1}) \right) \end{aligned}$$

The *finite horizon policy optimization* problem is to find a non-stationary policy π that maximizes its utility, given an initial state s_0 , i.e., $\underset{\pi}{argmax} ER_M(\pi, s_0)$.

Infinite Horizon Policy Optimization Policy optimization with infinite horizon is defined similar to finite horizon, except that a discount factor is introduced and the total reward is discounted: Given an infinite sequence of states and actions $\langle s_0, a_0, s_1, a_1, \dots \rangle$, such that each $s_i \in S$ and each $a_i \in A(i \in \{0, \dots\})$, and a discount factor $\gamma \in [0, 1]$, the *discounted total reward* of the sequence under MDP M is defined as

$$TR_M(\langle s_0, a_0, s_1, a_1, \dots \rangle) = \sum_{i=0}^{\infty} \gamma^{i+1} R(s_i, a_i, s_{i+1}).$$

The probability density of $\langle s_0, a_0, s_1, a_1, \dots \rangle$ under MDP M is defined as

$$P_M(\langle s_0, a_0, s_1, a_1, \dots \rangle) = \prod_{i=0}^{\infty} T(s_i, a_i, s_{i+1})$$

A *stationary policy* $\pi : S \rightarrow A$ is a function from S to A . Given an initial state s_0 , the *expected total reward* of a stationary policy π under MDP M is defined similar to the finite horizon case:

$$ER_M(\pi, s_0) = \sum_{\substack{\langle s_1, \dots \rangle: \\ s_i \in S \text{ for } i \in \{1, 2, \dots\}}} \left(\sum_{i=0}^{\infty} \gamma^{i+1} R(s_i, \pi(s_i), s_{i+1}) \right) \cdot \left(\prod_{i=0}^{\infty} T(s_i, \pi(s_i), s_{i+1}) \right).$$

The *infinite horizon policy optimization* problem is to find a stationary policy π that maximizes its utility, given an initial state s_0 , i.e.,

$$\underset{\pi}{argmax} ER_M(\pi, s_0).$$

Various algorithms for MDP policy optimization exist, such as value iteration [11] for exact solution, and Q-learning [12] for approximate solution.

B Proofs

It can be easily seen that Theorem 1, 2 and Corollary 1 in [7] still hold with the extension of $p\mathcal{BC}+$ with utility law.

B.1 Propositions and Lemmas

We write $\langle a_0, a_1, \dots, a_{m-1} \rangle^t$ (each $a_i \in \mathbf{A}$) to denote the formula $0 : a_0 \wedge 1 : a_1 \cdots \wedge m-1 : a_{m-1}$. The following lemma tells us that any action sequence has the same probability under $Tr(D, m)$.

Lemma 1. *For any $p\mathcal{BC}+$ action description D and any action sequence $\langle a_0, a_1, \dots, a_{m-1} \rangle^t$, we have*

$$P_{Tr(D, m)}(\langle a_0, a_1, \dots, a_{m-1} \rangle) = \frac{1}{(|\sigma^{act}| + 1)^m}.$$

Proof.

$$\begin{aligned}
& P_{Tr(D,m)}(\langle a_0, a_1, \dots, a_{m-1} \rangle^t) \\
= & \sum_{\substack{I \models \langle a_0, a_1, \dots, a_{m-1} \rangle^t \\ I \text{ is a stable models of } Tr(D, m)}} P_{Tr(D,m)}(I) \\
= & (\text{In } Tr(D, m) \text{ every total choice leads to } (|\sigma^{act}| + 1)^m \text{ stable models. By Proposition 2 in [?],}) \\
& \sum_{\substack{I \models \langle a_0, a_1, \dots, a_{m-1} \rangle^t \\ I \text{ is a stable models of } Tr(D, m)}} \frac{W_{Tr(D,m)}(I)}{(|\sigma^{act}| + 1)^m} \\
= & \frac{\sum_{tc \in TC_{Tr(D,m)}} \prod_{c=v \in tc} M_{\Pi}(c=v)}{(|\sigma^{act}| + 1)^m} \\
= & (\text{Derivations same as in the proof of Proposition 2 in [?]}) \\
& \frac{1}{(|\sigma^{act}| + 1)^m}
\end{aligned}$$

■

The following lemma states that given any action sequence, the probabilities of all possible state sequences sum up to 1.

Lemma 2. *For any pBC+ action description D and any action sequence $\langle a_0, a_1, \dots, a_{m-1} \rangle$, we have*

$$\sum_{s_0, \dots, s_m : s_i \in \mathbf{S}} P_{Tr(D,m)}(\langle s_0, \dots, s_m \rangle^t \mid \langle a_0, a_1, \dots, a_{m-1} \rangle^t) = 1.$$

Proof.

$$\begin{aligned}
& \sum_{s_0, \dots, s_m : s_i \in \mathbf{S}} P_{Tr(D,m)}(\langle s_0, \dots, s_m \rangle^t \mid \langle a_0, a_1, \dots, a_{m-1} \rangle^t) \\
= & (\text{By Corollary 1 in [?]}) \\
& \sum_{s_0, \dots, s_m : s_i \in \mathbf{S}} \prod_{i \in \{0, \dots, m-1\}} p(s_i, a_i, s_{i+1}) \\
= & \sum_{s_0 \in \mathbf{S}} (p(s_0) \cdot \sum_{s_1, \dots, s_m : s_i \in \mathbf{S}} \prod_{i \in \{1, \dots, m-1\}} p(s_i, a_i, s_{i+1})) \\
= & \sum_{s_0 \in \mathbf{S}} (p(s_0) \cdot \sum_{s_1 \in \mathbf{S}} (p(s_0, a_0, s_1) \cdot \sum_{s_2, \dots, s_m : s_i \in \mathbf{S}} \prod_{i \in \{2, \dots, m-1\}} p(s_i, a_i, s_{i+1}))) \\
= & \sum_{s_0 \in \mathbf{S}} (p(s_0) \cdot \sum_{s_1 \in \mathbf{S}} (p(s_0, a_0, s_1) \cdot \dots \cdot \sum_{s_m \in \mathbf{S}} p(s_{m-1}, a_{m-1}, s_m) \dots)) \\
= & 1.
\end{aligned}$$

■

The following proposition tells us that the probability of any state sequence conditioned on the constraint representation of a policy π coincide with the probability of the state sequence conditioned on the action sequence specified by π w.r.t. the state sequence.

Proposition 4 For any $p\mathcal{BC}+$ action description D , state sequence $\langle s_0, s_1, \dots, s_m \rangle$, and a non-stationary policy π , we have

$$\begin{aligned} & P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid C_{\pi,m}) = \\ & P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid 0:\pi(s_0, 0) \wedge \dots \wedge m-1:\pi(s_{m-1}, m-1)) \end{aligned}$$

Proof.

$$\begin{aligned} & P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid C_{\pi,m}) \\ &= \frac{P_{Tr(D,m)}(0:s_0 \wedge 1:s_1 \wedge \dots \wedge m:s_m \wedge C_{\pi,m})}{P_{Tr(D,m)}(C_{\pi,m})} \\ &= \frac{P_{Tr(D,m)}(0:s_0 \wedge 0:\pi(s_0, 0), 1:s_1 \wedge \dots \wedge m-1:\pi(s_{m-1}, m-1) \wedge m:s_m)}{P_{Tr(D,m)}(C_{\pi,m})} \\ &= \frac{P_{Tr(D,m)}(0:\pi(s_0, 0) \wedge 1:s_1 \wedge \dots \wedge m-1:\pi(s_{m-1}, m-1) \wedge m:s_m \mid 0:s_0) \cdot P_{Tr(D,m)}(0:s_0)}{\sum_{s'_0, \dots, s'_m: s'_i \in \mathbf{S}} P_{Tr(D,m)}(0:s'_0 \wedge 0:\pi(s'_0, 0), 1:s'_1 \wedge \dots \wedge m-1:\pi(s'_{m-1}, m-1) \wedge m:s'_m)}. \end{aligned}$$

We use $k(s_0, \dots, s_m)$ as an abbreviation of

$$P_{Tr(D,m)}(0:\pi(s_0, 0) \wedge \dots \wedge m-1:\pi(s_{m-1}, m-1)).$$

We have

$$\begin{aligned} & P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid C_{\pi,m}) \\ &= \frac{P_{Tr(D,m)}(1:s_1 \wedge \dots \wedge m:s_m \mid 0:s_0 \wedge 0:\pi(s_0, 0) \wedge m-1:\pi(s_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s_0) \cdot k(s_0, \dots, s_m)}{\sum_{s'_0, \dots, s'_m: s'_i \in \mathbf{S}} P_{Tr(D,m)}(1:s'_1 \wedge \dots \wedge m:s'_m \mid 0:s'_0 \wedge 0:\pi(s'_0, 0) \wedge \dots \wedge m-1:\pi(s'_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s'_0) \cdot k(s'_0, \dots, s'_m)} \\ &= (\text{By Lemma 1, for any } s_0, \dots, s_m (s_i \in \mathbf{S}), \text{ we have } k(s_0, \dots, s_m) = (|\sigma^{act}| + 1)^m) \\ & \quad \frac{P_{Tr(D,m)}(1:s_1 \wedge \dots \wedge m:s_m \mid 0:s_0 \wedge 0:\pi(s_0, 0) \wedge m-1:\pi(s_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s_0) \cdot \frac{1}{(|\sigma^{act}|+1)^m}}{\sum_{s'_0, \dots, s'_m: s'_i \in \mathbf{S}} P_{Tr(D,m)}(1:s'_1 \wedge \dots \wedge m:s'_m \mid 0:s'_0 \wedge 0:\pi(s'_0, 0) \wedge \dots \wedge m-1:\pi(s'_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s'_0) \cdot \frac{1}{(|\sigma^{act}|+1)^m}} \\ &= \frac{P_{Tr(D,m)}(1:s_1 \wedge \dots \wedge m:s_m \mid 0:s_0 \wedge 0:\pi(s_0, 0) \wedge m-1:\pi(s_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s_0)}{\sum_{s'_0, \dots, s'_m: s'_i \in \mathbf{S}} P_{Tr(D,m)}(1:s'_1 \wedge \dots \wedge m:s'_m \mid 0:s'_0 \wedge 0:\pi(s'_0, 0) \wedge \dots \wedge m-1:\pi(s'_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s'_0)} \\ &= (\text{By Lemma 2, the denominator equals 1}) \\ & \quad P_{Tr(D,m)}(1:s_1 \wedge \dots \wedge m:s_m \mid 0:s_0 \wedge 0:\pi(s_0, 0) \wedge m-1:\pi(s_{m-1}, m-1)) \cdot P_{Tr(D,m)}(0:s_0) \\ &= P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle \pi(s_0, 0), \dots, \pi(s_{m-1}, m-1) \rangle^t) \end{aligned}$$

■

The following proposition tells us that the expected utility of an action and state sequence can be computed by summing up the expected utility from each transition.

Proposition 5 For any $p\mathcal{BC}+$ action description D and a history $\langle s_0, a_0, s_1, \dots, a_{m-1}, s_m \rangle$, such that there exists at least one stable model of $Tr(D, m)$ that satisfies $\langle s_0, a_0, s_1, \dots, a_{m-1}, s_m \rangle$, we have

$$E[U_{Tr(D,m)}(\langle s_0, a_0, s_1, \dots, s_{m-1}, a_{m-1}, s_m \rangle^t)] = \sum_{i \in \{0, \dots, m-1\}} u(s_i, a_i, s_{i+1}).$$

Proof. Let X be any stable model of $Tr(D, m)$ that satisfies $\langle s_0, a_0, s_1, \dots, s_{m-1}, s_m \rangle^t$. By Proposition 1, we have

$$\begin{aligned}
& E[U_{Tr(D, m)}(\langle s_0, a_0, s_1, \dots, s_{m-1}, s_m \rangle^t)] \\
&= U_{Tr(D, m)}(X) \\
&= \sum_{i \in \{0, \dots, m-1\}} \left(\sum_{\substack{\text{utility}(v, i, \mathbf{x}) \leftarrow (i+1:F) \wedge (i:G) \in Tr(D, m) \\ X \text{ satisfies } (i+1 : F) \wedge (i : G)}} v \right) \\
&= \sum_{i \in \{0, \dots, m-1\}} \left(\sum_{\substack{\text{utility}(v, 0, \mathbf{x}) \leftarrow (1:F) \wedge (0:G) \in Tr(D, m) \\ 0 : X^i \text{ satisfies } (1 : F) \wedge (0 : G)}} v \right) \\
&= \sum_{i \in \{0, \dots, m-1\}} U_{Tr(D, 1)}(0 : X^i) \\
&= (\text{By Proposition 1}) \\
&\quad \sum_{i \in \{0, \dots, m-1\}} E[U_{Tr(D, 1)}(0 : s_i, 0 : a_i, 1 : s_{i+1})] \\
&= \sum_{i \in \{0, \dots, m-1\}} u(s_i, a_i, s_{i+1}).
\end{aligned}$$

■

B.2 Proofs of Proposition 1, Proposition 2, Theorem 1 and Theorem 2

The following proposition tells us that, for any states and actions sequence, any stable model of $Tr(D, m)$ that satisfies the sequence has the same utility. Consequently, the expected utility of the sequence can be computed by looking at any single stable model that satisfies the sequence.

Proposition 1 *For any two stable models X_1, X_2 of $Tr(D, m)$ that satisfy a particular states and actions sequence $\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle$, we have*

$$U_{Tr(D, m)}(X_1) = U_{Tr(D, m)}(X_2) = E[U_{Tr(D, m)}(\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle^t)].$$

Proof. Since both X_1 and X_2 both satisfy $\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle^t$, X_1 and X_2 agree on truth assignment on $\sigma_m^{act} \cup \sigma_m^{fl}$. Notice that atom of the form $\text{utility}(v, \mathbf{t})$ in $Tr(D, m)$ occurs only of the form (6), and only atom in $\sigma_m^{act} \cup \sigma_m^{fl}$ occurs in the body of rules of the form (6).

- Suppose an atom $\text{utility}(v, \mathbf{t})$ is in X_1 . Then the body B of at least one rule of the form (6) with $\text{utility}(v, \mathbf{t})$ in its head in $Tr(D, m)$ is satisfied by X_1 . B must be satisfied by X_2 as well, and thus $\text{utility}(v, \mathbf{t})$ is in X_2 as well.
- Suppose an atom $\text{utility}(v, \mathbf{t})$ is not in X_1 . Then, assume, to the contrary, that $\text{utility}(v, \mathbf{t})$ is in X_2 , then by the same reasoning process above in the first bullet, $\text{utility}(v, \mathbf{t})$ should be in X_1 as well, which is a contradiction. So $\text{utility}(v, \mathbf{t})$ is also not in X_2 .

So X_1 and X_2 agree on truth assignment on all atoms of the form $\text{utility}(v, \mathbf{t})$, and consequently we have $U_{Tr(D,m)}(X_1) = U_{Tr(D,m)}(X_2)$, as well as

$$\begin{aligned}
& E[U_{Tr(D,m)}(\langle s_0, a_0, s_1, a_1, \dots, a_{m-1}, s_m \rangle^t)] \\
&= \sum_{I \models \langle s_0, a_0, s_1, \dots, a_{m-1}, s_m \rangle^t} P_{Tr(D,m)}(I \mid \langle s_0, a_0, s_1, \dots, a_{m-1}, s_m \rangle^t) \cdot U_{Tr(D,m)}(I) \\
&= U_{Tr(D,m)}(X_1) \cdot \sum_{I \models \langle s_0, a_0, s_1, \dots, a_{m-1}, s_m \rangle^t} P_{Tr(D,m)}(I \mid \langle s_0, a_0, s_1, \dots, a_{m-1}, s_m \rangle^t) \\
&= (\text{The second term equals 1}) \\
& U_{Tr(D,m)}(X_1).
\end{aligned}$$

■

Proposition 2 *Given any initial state s_0 that is consistent with D_{init} , for any policy π , we have*

$$\begin{aligned}
& E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] = \\
& \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) \times P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}).
\end{aligned}$$

Proof. We have

$$\begin{aligned}
& E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] \\
&= \sum_{I \models 0:s_0 \wedge C_{\pi,m}} P_{Tr(D,m)}(I \mid 0:s_0 \wedge C_{\pi,m}) \cdot U_{Tr(D,m)}(I) \\
&= \sum_{\substack{I \models 0:s_0 \wedge C_{\pi,m} \\ I \text{ is a stable model of } Tr(D,m)}} P_{Tr(D,m)}(I \mid 0:s_0 \wedge C_{\pi,m}) \cdot U_{Tr(D,m)}(I) \\
&= (\text{We partition stable models } I \text{ according to their truth assignment on } \sigma_m^{ft}) \\
& \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} \sum_{\substack{I \models \langle 0:s_0, 1:s_1, \dots, m:s_m \rangle^t \wedge C_{\pi,m} \\ I \text{ is a stable model of } Tr(D,m)}} P_{Tr(D,m)}(I \mid 0:s_0 \wedge C_{\pi,m}) \cdot U_{Tr(D,m)}(I) \\
&= (\text{Since } I \models \langle s_0, s_1, \dots, s_m \rangle^t \wedge C_{\pi,m} \text{ implies } I \models \langle s_0, \pi(s_0, 0), s_1, \dots, s_m \rangle^t, \text{ by Proposition 1 we have}) \\
& \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} \sum_{\substack{I \models \langle s_0, s_1, \dots, s_m \rangle^t \wedge C_{\pi,m} \\ I \text{ is a stable model of } Tr(D,m)}} P_{Tr(D,m)}(I \mid 0:s_0 \wedge C_{\pi,m}) \cdot E[U_{Tr(D,m)}(\langle s_0, \pi(s_0, 0), s_1, \dots, s_m \rangle^t)] \\
&= \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} Pr_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid 0:s_0 \wedge C_{\pi,m}) \cdot E[U_{Tr(D,m)}(\langle s_0, \pi(s_0, 0), s_1, \dots, s_m \rangle^t)] \\
&= \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} Pr_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid 0:s_0 \wedge C_{\pi,m}) \cdot E[U_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \wedge C_{\pi,m})] \\
&= \sum_{\langle s_1, \dots, s_m \rangle : s_i \in \mathbf{S}} R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) \times P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}).
\end{aligned}$$

■

Theorem 1 *Given an initial state $s_0 \in \mathbf{S}$ that is consistent with D_{init} , for any policy π and any finite state sequence $\langle s_0, s_1, \dots, s_{m-1}, s_m \rangle$ such that each s_i in \mathbf{S} ($i \in \{0, \dots, m\}$), we have*

- $R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) = R_{M(D)}(\langle s_0, \pi(s_0,) \dots, \pi(s_{m-1}), s_m \rangle)$
- $P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}) = P_{M(D)}(\langle s_0, \pi(s_0,) \dots, \pi(s_{m-1}), s_m \rangle)$.

Proof. We have

$$\begin{aligned}
& R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) \\
&= E[U_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \wedge C_{\pi,m})] \\
&= (\text{By Proposition 5}) \\
&\quad \sum_{i \in \{0, \dots, m-1\}} u(s_i, \pi(s_i, i), s_{i+1}) \\
&= \sum_{i \in \{0, \dots, m-1\}} R(s_i, \pi(s_i, i), s_{i+1}) \\
&= R_{M(D)}(\langle s_0, \pi(s_0,) \dots, \pi(s_{m-1}), s_m \rangle)
\end{aligned}$$

and

$$\begin{aligned}
& P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}) \\
&= (\text{By Proposition 4}) \\
&\quad Pr_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle \mid s_0 \wedge 0: \pi(s_0, 0) \wedge \dots \wedge m-1: \pi(s_{m-1}, m-1)) \\
&= (\text{By Corollary 1 in [?]}) \\
&\quad \prod_{i \in \{0, \dots, m-1\}} p(\langle s_i, \pi(s_i, i), s_{i+1} \rangle) \\
&= P_{M(D)}(\langle s_0, \pi(s_0,) \dots, \pi(s_{m-1}), s_m \rangle)
\end{aligned}$$

■

Theorem 2 For any nonnegative integer m and an initial state $s_0 \in \mathbf{S}$ that is consistent with D_{init} , we have

$$\operatorname{argmax}_{\pi \text{ is a policy}} E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] = \operatorname{argmax}_{\pi} ER_{M(D)}(\pi, s_0).$$

Proof. We show that for any non-stationary policy π ,

$$E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] = ER_{M(D)}(\pi, s_0).$$

We have

$$\begin{aligned}
& E[U_{Tr(D,m)}(C_{\pi,m} \wedge \langle s_0 \rangle^t)] \\
&= (\text{By Proposition 2}) \\
&\quad \sum_{\langle s_1, \dots, s_m \rangle: s_i \in \mathbf{S}} R_D(\langle s_0, \pi(s_0), s_1, \dots, \pi(s_{m-1}), s_m \rangle) \times P_{Tr(D,m)}(\langle s_0, s_1, \dots, s_m \rangle^t \mid \langle s_0 \rangle^t \wedge C_{\pi,m}). \\
&= (\text{By Theorem 1}) \\
&\quad \sum_{\langle s_1, \dots, s_m \rangle: s_i \in \mathbf{S}} R_{M(D)}(\langle s_0, \pi(s_0, 0) \dots, \pi(s_{m-1}, m-1), s_m \rangle) \cdot P_{M(D)}(\langle s_0, \pi(s_0, 0) \dots, \pi(s_{m-1}, m-1), s_m \rangle) \\
&= ER_{M(D)}(\pi, s_0).
\end{aligned}$$

■

C Expanded Related Work

There have been quite a few studies and attempts in defining high-level representations of (PO)MDP, with feature-based state descriptions and more compact, human-readable action definitions. PPDDL [8] is a probabilistic extension of the Planning Domain Definition Language (PDDL), which extends PDDL to defining domains involving probabilistic effects of actions and reward from state transitions. It introduces the syntactic construct probabilistic effect of the form

$$(\text{probabilistic } p_1 \ e_1 \ \dots \ p_k \ e_k)$$

to PDDL action schema, which associates probabilities p_1, \dots, p_k to effects e_1, \dots, e_k . The effects are arbitrary formulas that can again contain probabilistic effects. The arbitrary nesting of effects allows flexible representations of effects of actions. The transitions and rewards of the underlying MDP, though, is defined assuming that the action effects are turned into some normal form. The states of the MDP are all possible value combinations of the fluents, and the entries of transition and reward matrices are filled out according to the satisfaction of the effect w.r.t. the the corresponding transition.

One drawback of PPDDL is the lack of state constraints. In many domains, features used to define states are not independent from each other. In these domains, some combination of fluent values do not yield a valid state. Although invalid combinations of fluent values can be simulated by unreachable states, including all such invalid combinations as states unnecessarily increases the size of the domain. With PBCPLUS2MDP, such invalid combinations can be pruned out with static laws in $p\mathcal{BC}+$, and removed from the state space given to the MDP solver.

Another weakness of PPDDL lies in the limitation on expressivity due to simple satisfaction checking in determining valid transitions. Action effects involving recursive definitions or transitive closures are hard to be expressed, while in $p\mathcal{BC}+$, the stable model semantics makes it quite straightforward to express recursive definitions or transitive closures.

To illustrate the above two points, let us consider the Example 2. In this example, many value combinations of fluents do not lead to a valid state, such as

$$\{OnTopOf(B1, B2), OnTopOf(B2, B1), \dots\}$$

where the two blocks B1 and B2 are on top of each other. Moreover, the fluents $TopClear(x)$ and $Above(x_1, x_2)$ are completely dependent on the value of the other fluents. There would be $2^{3+3+3+3+3+3} = 2^{24}$ states if we define a state as any value combination of fluents. On the other hand, the static laws in the above action descriptions reduce the number of states to only 44. To see this, consider all possible configurations with 3 blocks and 2 locations. As illustrated in Figure 2, there are 13 possible configurations with 3 blocks on the same side, and 9 possible configurations with one block one side and two on the other side. Each configuration can be mirrored to yield another configuration, so we have $(13+9) \times 2 = 44$ in total. This is aligned with the number of states detected by our system PBCPLUS2MDP.

In terms of representation, this example is hard to represent in PPDDL because $Above(x, y)$ needs to be defined as a transitive closure of $OnTopOf(x, y)$, so that the effects of $StackOn(b_1, b_2)$ can be defined in terms of the (inferred) spatial relation of blocks. Also, the static law

$$\text{caused } At(x_1, l) \text{ if } Above(x_1, x_2) \wedge At(x_2, l_2)$$

defines one indirect effect of $MoveTo(b, l)$. With PPDDL, it is hard to come up with action schemas for $MoveTo(b, l)$ and $StackOn(b_1, b_2)$ that are compact and do not depend on specific number of blocks and locations.

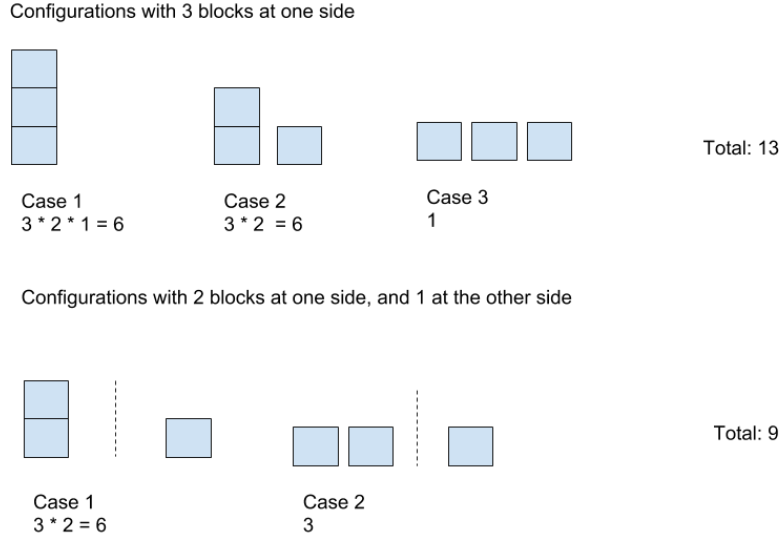


Fig. 2. Possible Configurations with 3 blocks and 2 locations

RDDL (Relational Dynamic Influence Diagram Language) [9] improves the expressivity of PPDDL in modeling stochastic planning domains by allowing concurrent actions, continuous value of fluents, state constraints, etc. The semantics is defined in terms of lifted dynamic Bayes network extended with influence graph. A lifted planner can utilize the first-order representation and potentially achieve better performance. Still, action domains involving recursive definitions are hard to represent with RDDL.

Our work can be viewed as an attempt to combine symbolic reasoning with reinforcement learning, as the symbolic reasoning language $p\mathcal{BC}+$ is evaluated through LP^{MLN} to provide input to reinforcement learning based MDP solvers. Similarly, [14] adopts ASP and probabilistic extension of ASP, P-Log[?], to perform high-level symbolic reasoning, which, respectively produce a refined set of states and a refined probability distribution over states that are then fed to POMDP solvers for low-level planning. The refined sets of states and probability distribution over states take into account commonsense knowledge about the domain, and thus improves the quality of plan and reduces computation needed at POMDP level. [16] adopts the (deterministic) action description language \mathcal{BC} for high-level representations of the action domain, which defines high-level actions that can be treated as deterministic. The language is executed through an ASP solver CLINGCON. Each action in the generated high-level plan are then mapped into more detailed low-level policies, which takes in stochastic effects of low-level actions into account. During the execution of the low-level plan, the agent discovers expected reward of transitions, and communicate the information to the \mathcal{BC} action description through built-in fluents defining quality of transitions, which affects future high-level planning, and thus form a learning loop. Compared to PBCPLUS2MDP, these approaches are looser integration of their symbolic reasoning module

and reinforcement learning module. Moreover, the interface between the two components are specific to the domain.

Another work on this track is [17], which combines ASP and reinforcement learning by using action language $\mathcal{BC}+$ ⁶ as a meta-level description of MDP. The $\mathcal{BC}+$ action descriptions defines non-stationary MDPs in the sense that the states and actions can change with new situations occurring in the environment. The algorithm ASP(RL) proposed in this work iteratively calls ASP solver to obtain states and actions for the RL methods to learning transition probabilities and rewards, and updates the $\mathcal{BC}+$ action description with changes in the environment found by the RL methods, in this way finding optimal policy for a non-stationary MDP with the search space reduced by ASP. The work is similar to our work in that ASP-based high-level logical description is used to generate states and actions for MDP, but is different from our work in that in our work the action language also captures transition probabilities and rewards.

D System PBCPLUS2MDP

We implement system PBCPLUS2MDP, which takes an action description D and time horizon m as input, and finds the optimal policy by constructing the corresponding MDP $M(D)$ and utilizing MDP policy optimization algorithms as black box. We use MDPTOOLBOX⁷ as our underlying MDP solver. The current system uses LP^{MLN} 1.0 (<http://reasoning.eas.asu.edu/lpmln/index.html>) for exact inference to find states, actions, transition probabilities and transition rewards. The system is publically available at <https://github.com/ywang485/pbcplus2mdp>, along with several examples.

We measure the scalability of our system PBCPLUS2MDP on Example 2. Table 1 shows the running statistics of finding the optimal policy for different number of blocks. For all of the running instances, maximum time horizon is set to be 10, as in all of the instances, the smallest number of steps in a shortest possible action sequence achieving the goal is less than 10. The experiments are performed on a machine with 4 Intel(R) Core(TM) i5-2400 CPU with OS Ubuntu 14.04.5 LTS and 8 GB memory.

# Blocks	# State	# Actions	LP^{MLN} Solving Time	MDP Solving Time	Overall Solving Time
1	2	4	0.902s	0.0005	1.295s
2	8	9	0.958s	0.0014s	1.506s
3	44	16	1.634s	0.0017s	2.990s
4	304	25	12.256s	0.0347s	27.634s
5	2512	36	182.190s	2.502	10m23.929s
6	24064	49	> 1 hr	-	-

Table 1. Running Statistics of PBCPLUS2MDP system

As can be seen from the table, the running time increases exponentially as the number of blocks increases. This is not surprising since the size of the search space increases exponentially as the number of blocks increases. The bottleneck is the LP^{MLN} inference system, as it needs to enumerate every stable model to generate the set of states, the set of actions, and transition probabilities and rewards. Time spent on MDP planning is negligible.

System PBCPLUS2MDP supports planning with infinite horizon. However, it should be noted that the semantics of an action description with infinite time horizon in terms of DT –

⁶ The semantics of $\mathcal{BC}+$ is defined in terms of a translation to ASP programs.

⁷ <https://pymdptoolbox.readthedocs.io>

LP^{MLN} is not yet well established. In this case, the action description is only viewed as a high-level representation of an MDP.

Algorithm 1 details how PBCPLUS2MDP solves the policy optimization problem of an $pBC+$ action description. We assume that the answer sets of $Tr(D, 0) = D_{init} \cup D_0$ coincide with D_0 , i.e., D_{init} does not prune out any state from being possible initial state. Consequently, the states of an action description can be obtained by listing the stable models of $Tr(D, 0)$.

Algorithm 1 PBCPLUS2MDP system

Input:

1. $Tr(D, m)$: A $pBC+$ action description translated into LP^{MLN} program, parameterized with maxstep m , with states set \mathbf{S} and action sets \mathbf{A}
2. T : time horizon
3. γ : discount factor

Output: Optimal policy

Procedure:

1. Execute LPMLN2ASP on $Tr(D, m)$ with $m = 0$ to obtain all stable models of $Tr(D, 0)$; project each stable model of $Tr(D, 0)$ to only predicates corresponding to fluent constant (marked by `fl_` prefix); assign a unique number $idx(s) \in \{0, \dots, |\mathbf{S}| - 1\}$ to each of the projected stable model s of $Tr(D, 0)$;
2. Execute LPMLN2ASP on $Tr(D, m)$ with $m = 1$ and the clingo option `--project` to project stable models to only predicates corresponding to action constant (marked by `act_` prefix); assign a unique number $idx(a) \in \{0, \dots, |\mathbf{A}| - 1\}$ to each of the projected stable model a of $Tr(D, 1)$;
3. Initialize 3-dimensional matrix P of shape $(|\mathbf{A}|, |\mathbf{S}|, |\mathbf{S}|)$;
4. Initialize 3-dimensional matrix R of shape $(|\mathbf{A}|, |\mathbf{S}|, |\mathbf{S}|)$;
5. Construct ASP rules ST_ACT_DEF :

$$\{\text{start_state}(idx(s)) \leftarrow 0 : s \in \mathbf{S}\} \cup \{\text{end_state}(idx(s)) \leftarrow 1 : s \in \mathbf{S}\} \cup \{\text{action_idx}(idx(a)) \leftarrow 0 : a \in \mathbf{A}\}$$

6. Execute LPMLN2ASP on $Tr(D, m) \cup ST_ACT_DEF$ with $m = 1$ and the option `-all` to obtain all stable models of $Tr(D, 1)$; Store all the stable models of $Tr(D, 1)$ with a dictionary AS so that

$$AS(s, a, s') = \{(X, P_{Tr(D, 1)}(X)) \mid X \text{ is the stable model of } Tr(D, 1) \text{ such that} \\ \text{start_state}(idx(s)), \text{end_state}(idx(s')), \text{action_idx}(idx(a)) \in X\}$$

7. For each state $s \in \mathbf{S}$ and action $a \in \mathbf{A}$:

$$(a) \text{ Obtain } P_{Tr(D, 1)}(1 : s' \mid 0 : s, 0 : a) \text{ as } \frac{\sum_{\substack{(X, p) \in AS(s, a, s') \\ s' \in \mathbf{S}}} p}{\sum_{(X, p) \in AS(s, a, s')} p};$$

- (b) Obtain $E[U_{Tr(D, 1)}(1 : s', 0 : s, 0 : a)]$ by arbitrarily picking one (X, p) from $AS(s, a, s')$ and summing up the first arguments of all predicates named `utility`;

$$(c) P(idx(a), idx(s), idx(s')) \leftarrow P_{Tr(D, 1)}(1 : s' \mid 0 : s, 0 : a);$$

$$(d) R(idx(a), idx(s), idx(s')) \leftarrow E[U_{Tr(D, 1)}(1 : s', 0 : s, 0 : a)];$$

8. Call finite horizon policy optimization algorithm of PYMDPTOOLBOX with transition matrix P , reward matrix R , time horizon T and discount factor γ ; return the output.
-

Example 4. The LP^{MLN} translation of the $pBC+$ action description in Example 2 is listed below:

```

astep(0..m-1).
step(0..m).
boolean(t; f).

block(b1 b2; b3).
location(l1; l2).

%% UEC
:- fl_Above(X1, X2, t, I), fl_Above(X1, X2, f, I).
:- not fl_Above(X1, X2, t, I), not fl_Above(X1, X2, f, I), block(X1), block(X2), step(I).
:- fl_TopClear(X, t, I), fl_TopClear(X, f, I).
:- not fl_TopClear(X, t, I), not fl_TopClear(X, f, I), block(X), step(I).
:- fl_GoalNotAchieved(t, I), fl_GoalNotAchieved(f, I).
:- not fl_GoalNotAchieved(t, I), not fl_GoalNotAchieved(f, I), step(I).

:- fl_At(X, L1, I), fl_At(X, L2, I), L1 != L2.
:- not fl_At(X, L1, I), not fl_At(X, L2, I), block(X), step(I).
:- fl_OnTopOf(X1, X2, t, I), fl_OnTopOf(X1, X2, f, I).
:- not fl_OnTopOf(X1, X2, t, I), not fl_OnTopOf(X1, X2, f, I), block(X1), block(X2),
    step(I).

:- act_StackOn(X1, X2, t, I), act_StackOn(X1, X2, f, I).
:- not act_StackOn(X1, X2, t, I), not act_StackOn(X1, X2, f, I), block(X1), block(X2),
    astep(I).
:- act_MoveTo(X, L, t, I), act_MoveTo(X, L, f, I).
:- not act_MoveTo(X, L, t, I), not act_MoveTo(X, L, f, I), block(X), location(L), astep(I).

:- pf_Move(t, I), pf_Move(f, I).
:- not pf_Move(t, I), not pf_Move(f, I), astep(I).

% ----- PF(D) -----
%% Probability Distribution
@log(0.8) pf_Move(t, I) :- astep(I).
@log(0.2) pf_Move(f, I) :- astep(I).

%% Initial State and Actions are Random
{fl_OnTopOf(X1, X2, B, 0)} :- block(X1), block(X2), boolean(B).
{fl_At(X, L, 0)} :- block(X), location(L), boolean(B).
{act_StackOn(X1, X2, B, I)} :- block(X1), block(X2), boolean(B), astep(I).
{act_MoveTo(X, L, B, I)} :- block(X), location(L), boolean(B), astep(I).

%% No Concurrency
:- act_StackOn(X1, X2, t, I), act_StackOn(X3, X4, t, I), astep(I), X1 != X3.
:- act_StackOn(X1, X2, t, I), act_StackOn(X3, X4, t, I), astep(I), X2 != X4.
:- act_MoveTo(X1, L1, t, I), act_MoveTo(X2, L2, t, I), astep(I), X1 != X2.
:- act_MoveTo(X1, L1, t, I), act_MoveTo(X2, L2, t, I), astep(I), L1 != L2.
:- act_StackOn(X1, X2, t, I), act_MoveTo(X3, L, t, I), astep(I).

```

```

%% Static Laws
fl_GoalNotAchieved(t, I) :- fl_At(X, L, I), L != l2.
fl_GoalNotAchieved(f, I) :- not fl_GoalNotAchieved(t, I), step(I).
:- fl_OnTopOf(X1, X, t, I), fl_OnTopOf(X2, X, t, I), X1 != X2.
:- fl_OnTopOf(X, X1, t, I), fl_OnTopOf(X, X2, t, I), X1 != X2.
fl_Above(X1, X2, t, I) :- fl_OnTopOf(X1, X2, t, I).
fl_Above(X1, X2, t, I) :- fl_Above(X1, X, t, I), fl_Above(X, X2, t, I).
:- fl_Above(X1, X2, t, I), fl_Above(X2, X1, t, I).
fl_At(X1, L, I) :- fl_Above(X1, X2, t, I), fl_At(X2, L, I).
fl_Above(X1, X2, f, I) :- not fl_Above(X1, X2, t, I), block(X1), block(X2), step(I).
fl_TopClear(X, f, I) :- fl_OnTopOf(X1, X, t, I).
fl_TopClear(X, t, I) :- not fl_TopClear(X, f, I), block(X), step(I).

%% Fluent Dynamic Laws
fl_At(X, L, I+1) :- act_MoveTo(X, L, t, I), pf_Move(t, I), fl_GoalNotAchieved(f, I).
fl_OnTopOf(X1, X2, t, I+1) :- act_StackOn(X1, X2, t, I), X1 != X2, fl_TopClear(X2, t, I), not fl_Above(X2, X1, t, I), fl_At(X1, L, I), fl_At(X2, L, I), fl_GoalNotAchieved(f, I).
fl_OnTopOf(X1, X2, f, I+1) :- act_MoveTo(X1, L2, t, I), pf_Move(t, I), fl_At(X1, L1, I), fl_OnTopOf(X1, X2, t, I), L1 != L2, fl_GoalNotAchieved(f, I).
fl_OnTopOf(X1, X, f, I+1) :- act_StackOn(X1, X2, t, I), X1 != X2, fl_TopClear(X2, t, I), not fl_Above(X2, X1, t, I), fl_At(X1, L, I), fl_At(X2, L, I), fl_OnTopOf(X1, X, t, I), X != X2, fl_GoalNotAchieved(f, I).
{fl_OnTopOf(X1, X2, B, I+1)} :- fl_OnTopOf(X1, X2, B, I), astep(I), boolean(B).
{fl_At(X, L, I+1)} :- fl_At(X, L, I), astep(I), boolean(B).

%% Utility Laws
utility(-l, X, L, I) :- act_MoveTo(X, L, t, I).
utility(10) :- fl_GoalNotAchieved(f, I+1), fl_GoalNotAchieved(t, I).

```

We store this LP^{MLN} program as `block.lpmln`. Executing PBCPLUS2MDP system with the command line

```
python pbcplus2mdp.py block.lpmln 3 0.9
```

yields the output

```

Action Description in lpmln:  examples/blocks.lpmln
Time Horizon:  4
44 states detected.
16 actions detected.
Transition Probabilities:
action 0 act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
      act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
      b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
      act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
      l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 1.  0.  0. ...,  0.  0.  0.]
 [ 0.  1.  0. ...,  0.  0.  0.]
 [ 0.  0.  1. ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0. ...,  1.  0.  0.]
 [ 0.  0.  0. ...,  0.  1.  0.]
 [ 0.  0.  0. ...,  0.  0.  1.]]

```

```

action 1 act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,t,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 1.  0.  0. ...,  0.  0.  0.]
 [ 0.  1.  0. ...,  0.  0.  0.]
 [ 0.  0.  1. ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0. ...,  1.  0.  0.]
 [ 0.  0.  0. ...,  0.  1.  0.]
 [ 0.  0.  0. ...,  0.  0.  1.]]
action 2 act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,t,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 1.  0.  0. ...,  0.  0.  0.]
 [ 0.  1.  0. ...,  0.  0.  0.]
 [ 0.  0.  1. ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0. ...,  1.  0.  0.]
 [ 0.  0.  0. ...,  0.  1.  0.]
 [ 0.  0.  0. ...,  0.  0.  1.]]
action 3 act_StackOn(b1,b1,t,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 1.  0.  0. ...,  0.  0.  0.]
 [ 0.  1.  0. ...,  0.  0.  0.]
 [ 0.  0.  1. ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0. ...,  1.  0.  0.]
 [ 0.  0.  0. ...,  0.  1.  0.]
 [ 0.  0.  0. ...,  0.  0.  1.]]
action 4 act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,
        l2,f,0),act_MoveTo(b2,l2,f,0)
[[ 1.      0.      0.      ...,  0.      0.      0.      ]
 [ 0.      1.      0.      ...,  0.      0.      0.      ]
 [ 0.      0.      1.      ...,  0.      0.      0.      ]
 ...,
 [ 0.      0.      0.      ...,  0.1999991  0.      0.      ]
 [ 0.      0.      0.      ...,  0.      0.1999991  0.      ]
 [ 0.      0.      0.      ...,  0.      0.      0.1999991]]
action 5 act_MoveTo(b3,l1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,
        l2,f,0),act_MoveTo(b2,l2,f,0)

```



```

[ [ 0.1999991 0. 0. ..., 0. 0. 0. ]
[ 0. 0.1999991 0. ..., 0. 0. 0. ]
[ 0. 0. 0.1999991 ..., 0. 0. 0. ]
...,
[ 0. 0. 0. ..., 1. 0. 0. ]
[ 0. 0. 0. ..., 0. 1. 0. ]
[ 0. 0. 0. ..., 0. 0. 1. ]]
action 6 act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)
[ [ 1. 0. 0. ..., 0. 0. 0. ]
[ 0. 1. 0. ..., 0. 0. 0. ]
[ 0. 0. 1. ..., 0. 0. 0. ]
...,
[ 0. 0. 0. ..., 0.1999991 0. 0. ]
[ 0. 0. 0. ..., 0. 0.1999991 0. ]
[ 0. 0. 0. ..., 0. 0. 0.1999991]]
action 7 act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)
[ [ 1. 0. 0. ..., 0. 0. 0. ]
[ 0. 1. 0. ..., 0. 0. 0. ]
[ 0. 0. 1. ..., 0. 0. 0. ]
...,
[ 0. 0. 0. ..., 0.1999991 0. 0. ]
[ 0. 0. 0. ..., 0. 0.1999991 0. ]
[ 0. 0. 0. ..., 0. 0. 0.1999991]]
action 8 act_MoveTo(b1,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)
[ [ 0.1999991 0. 0. ..., 0. 0. 0. ]
[ 0. 0.1999991 0. ..., 0. 0. 0. ]
[ 0. 0. 0.1999991 ..., 0. 0. 0. ]
...,
[ 0. 0. 0. ..., 1. 0. 0. ]
[ 0. 0. 0. ..., 0. 1. 0. ]
[ 0. 0. 0. ..., 0. 0. 1. ]]
action 9 act_MoveTo(b2,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)
[ [ 0.1999991 0. 0. ..., 0. 0. 0. ]
[ 0. 0.1999991 0. ..., 0. 0. 0. ]
[ 0. 0. 0.1999991 ..., 0. 0. 0. ]
...,
[ 0. 0. 0. ..., 1. 0. 0. ]

```

```

[ 0.      0.      0.      ..., 0.      1.      0.      ]
[ 0.      0.      0.      ..., 0.      0.      1.      ]]
action 10 act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 0.  0.  1.  ...,  0.  0.  0.]
 [ 0.  1.  0.  ...,  0.  0.  0.]
 [ 0.  0.  1.  ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0.  ...,  1.  0.  0.]
 [ 0.  0.  0.  ...,  0.  1.  0.]
 [ 0.  0.  0.  ...,  0.  0.  1.]]
action 11 act_StackOn(b3,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 0.  0.  0.  ...,  0.  0.  0.]
 [ 0.  0.  0.  ...,  0.  0.  0.]
 [ 0.  0.  1.  ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0.  ...,  1.  0.  0.]
 [ 0.  0.  0.  ...,  0.  1.  0.]
 [ 0.  0.  0.  ...,  0.  0.  1.]]
action 12 act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 0.  0.  0.  ...,  0.  0.  0.]
 [ 0.  0.  0.  ...,  0.  0.  0.]
 [ 0.  0.  0.  ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0.  ...,  1.  0.  0.]
 [ 0.  0.  0.  ...,  0.  1.  0.]
 [ 0.  0.  0.  ...,  0.  0.  1.]]
action 13 act_StackOn(b3,b2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
        act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
        l2,f,0),act_MoveTo(b3,l2,f,0)
[[ 0.  0.  0.  ...,  0.  0.  0.]
 [ 0.  1.  0.  ...,  0.  0.  0.]
 [ 0.  0.  0.  ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0.  ...,  1.  0.  0.]
 [ 0.  0.  0.  ...,  0.  1.  0.]
 [ 0.  0.  0.  ...,  0.  0.  1.]]
action 14 act_StackOn(b2,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),

```

```

        act_MoveTo(b2, l1, f, 0), act_MoveTo(b3, l1, f, 0), act_MoveTo(b1, l2, f, 0), act_MoveTo(b2,
        l2, f, 0), act_MoveTo(b3, l2, f, 0)
[[ 0. 1. 0. ..., 0. 0. 0.]
 [ 0. 1. 0. ..., 0. 0. 0.]
 [ 0. 0. 1. ..., 0. 0. 0.]
 ...,
 [ 0. 0. 0. ..., 1. 0. 0.]
 [ 0. 0. 0. ..., 0. 1. 0.]
 [ 0. 0. 0. ..., 0. 0. 1.]]
action 15 act_StackOn(b1, b2, t, 0), act_StackOn(b1, b1, f, 0), act_StackOn(b2, b1, f, 0),
        act_StackOn(b3, b1, f, 0), act_StackOn(b2, b2, f, 0), act_StackOn(b3, b2, f, 0), act_StackOn(
        b1, b3, f, 0), act_StackOn(b2, b3, f, 0), act_StackOn(b3, b3, f, 0), act_MoveTo(b1, l1, f, 0),
        act_MoveTo(b2, l1, f, 0), act_MoveTo(b3, l1, f, 0), act_MoveTo(b1, l2, f, 0), act_MoveTo(b2,
        l2, f, 0), act_MoveTo(b3, l2, f, 0)
[[ 0. 0. 0. ..., 0. 0. 0.]
 [ 0. 0. 0. ..., 0. 0. 0.]
 [ 0. 0. 0. ..., 0. 0. 0.]
 ...,
 [ 0. 0. 0. ..., 1. 0. 0.]
 [ 0. 0. 0. ..., 0. 1. 0.]
 [ 0. 0. 0. ..., 0. 0. 1.]]
Transition Rewards:
action 0 act_StackOn(b1, b1, f, 0), act_StackOn(b2, b1, f, 0), act_StackOn(b3, b1, f, 0),
        act_StackOn(b1, b2, f, 0), act_StackOn(b2, b2, f, 0), act_StackOn(b3, b2, f, 0), act_StackOn(
        b1, b3, f, 0), act_StackOn(b2, b3, f, 0), act_StackOn(b3, b3, f, 0), act_MoveTo(b1, l1, f, 0),
        act_MoveTo(b2, l1, f, 0), act_MoveTo(b3, l1, f, 0), act_MoveTo(b1, l2, f, 0), act_MoveTo(b2,
        l2, f, 0), act_MoveTo(b3, l2, f, 0)
[[ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]
 ...,
 [ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]]
action 1 act_StackOn(b1, b1, f, 0), act_StackOn(b2, b1, f, 0), act_StackOn(b3, b1, f, 0),
        act_StackOn(b1, b2, f, 0), act_StackOn(b2, b2, f, 0), act_StackOn(b3, b2, f, 0), act_StackOn(
        b1, b3, f, 0), act_StackOn(b2, b3, f, 0), act_StackOn(b3, b3, t, 0), act_MoveTo(b1, l1, f, 0),
        act_MoveTo(b2, l1, f, 0), act_MoveTo(b3, l1, f, 0), act_MoveTo(b1, l2, f, 0), act_MoveTo(b2,
        l2, f, 0), act_MoveTo(b3, l2, f, 0)
[[ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]
 ...,
 [ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]]
action 2 act_StackOn(b1, b1, f, 0), act_StackOn(b2, b1, f, 0), act_StackOn(b3, b1, f, 0),
        act_StackOn(b1, b2, f, 0), act_StackOn(b2, b2, t, 0), act_StackOn(b3, b2, f, 0), act_StackOn(
        b1, b3, f, 0), act_StackOn(b2, b3, f, 0), act_StackOn(b3, b3, f, 0), act_MoveTo(b1, l1, f, 0),
        act_MoveTo(b2, l1, f, 0), act_MoveTo(b3, l1, f, 0), act_MoveTo(b1, l2, f, 0), act_MoveTo(b2,
        l2, f, 0), act_MoveTo(b3, l2, f, 0)
[[ 0 0 0 ..., 0 0 0]
 [ 0 0 0 ..., 0 0 0]

```

```

[0 0 0 ..., 0 0 0]
...,
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
action 3 act_StackOn(b1,b1,t,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
        act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)
[[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
...,
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
action 4 act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
        12,f,0),act_MoveTo(b2,12,f,0)
[[-1 0 0 ..., 0 0 0]
[0 -1 0 ..., 0 0 0]
[0 0 -1 ..., 0 0 0]
...,
[0 0 0 ..., -1 0 0]
[0 0 0 ..., 0 -1 0]
[0 0 0 ..., 0 0 -1]]
action 5 act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)
[[-1 0 0 ..., 0 0 0]
[0 -1 0 ..., 0 0 0]
[0 0 -1 ..., 0 0 0]
...,
[0 0 0 ..., -1 0 0]
[0 0 0 ..., 0 -1 0]
[0 0 0 ..., 0 0 -1]]
action 6 act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
        12,f,0),act_MoveTo(b3,12,f,0)
[[-1 0 0 ..., 0 0 0]
[0 -1 0 ..., 0 0 0]
[0 0 -1 ..., 0 0 0]
...,
[0 0 0 ..., -1 0 0]
[0 0 0 ..., 0 -1 0]
[0 0 0 ..., 0 0 -1]]

```

```

action 7 act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)
[[-1 0 0 ..., 0 0 0]
 [ 0 -1 0 ..., 0 0 0]
 [ 0 0 -1 ..., 0 0 0]
 ...,
 [ 0 0 0 ..., -1 0 0]
 [ 0 0 0 ..., 0 -1 0]
 [ 0 0 0 ..., 0 0 -1]]
action 8 act_MoveTo(b1,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)
[[-1 0 0 ..., 0 0 0]
 [ 0 -1 0 ..., 0 0 0]
 [ 0 0 -1 ..., 0 0 0]
 ...,
 [ 0 0 0 ..., -1 0 0]
 [ 0 0 0 ..., 0 -1 0]
 [ 0 0 0 ..., 0 0 -1]]
action 9 act_MoveTo(b2,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
        act_MoveTo(b1,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)
[[-1 0 0 ..., 0 0 0]
 [ 0 -1 0 ..., 0 0 0]
 [ 0 0 -1 ..., 0 0 0]
 ...,
 [ 0 0 0 ..., -1 0 0]
 [ 0 0 0 ..., 0 -1 0]
 [ 0 0 0 ..., 0 0 -1]]
action 10 act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
        b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
        act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)
[[0 0 0 ..., 0 0 0]
 [0 0 0 ..., 0 0 0]
 [0 0 0 ..., 0 0 0]
 ...,
 [0 0 0 ..., 0 0 0]
 [0 0 0 ..., 0 0 0]
 [0 0 0 ..., 0 0 0]]
action 11 act_StackOn(b3,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
        act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
        b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
        act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
        12,f,0),act_MoveTo(b3,12,f,0)

```

```

[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]

...,
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
action 12 act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]

...,
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
action 13 act_StackOn(b3,b2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]

...,
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
action 14 act_StackOn(b2,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]

...,
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
action 15 act_StackOn(b1,b2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]

...,
[0 0 0 ..., 0 0 0]

```

```
[0 0 0 ..., 0 0 0]
[0 0 0 ..., 0 0 0]]
```

Raw Optimal Policy Output:

```
[[ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 5 5 5 0]
 [ 4 4 4 4]
 [ 4 4 4 4]
 [ 4 4 4 4]
 [ 6 6 6 6]
 [ 6 6 6 6]
 [ 6 6 6 6]
 [13 13 13 0]
 [ 4 4 4 4]
 [ 6 6 6 6]
 [ 7 7 7 7]
 [ 7 7 7 7]
 [ 7 7 7 7]
 [10 10 10 0]
 [ 7 7 7 7]
 [ 4 4 4 4]
 [12 12 12 0]
 [ 7 7 7 7]
 [ 6 6 6 6]
 [10 10 0 0]
 [10 10 10 0]
 [11 11 11 0]
 [11 11 11 0]
 [12 12 12 0]
 [ 4 4 4 4]
 [ 6 6 6 6]
 [10 10 10 0]
 [ 4 4 4 4]
 [14 14 14 0]
 [ 7 7 7 7]
 [ 6 6 6 6]
 [ 7 7 7 7]]
```

Optimal Policy:

```
----- Time step 0 -----:
state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
       fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3
       ,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
       b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),
```


state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0)

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,
b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(
b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,
b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t
,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,l2,0),
 fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
 b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
 b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
 fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
 b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b3,b2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
 act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
 l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t,
 0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,l2,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(
 b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
 b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
 b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
 fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,
 l2,f,0),act_MoveTo(b2,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t,
 0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,l2,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(
 b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
 b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
 b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,
 l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,l1,0),
 fl_At(b2,l2,0),fl_At(b3,l2,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
 b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
 b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
 fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
 b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t
,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3
,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),
fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3
,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1
,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t
,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b3,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0)

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b2,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t
,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b3,
b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(
b2,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),
fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,
b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t
,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,
b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(
b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,
b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

----- Time step 1 ----- :

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t
,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0)

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t,
0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,
0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),
fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,
0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t,
0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),
fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),

act_MoveTo(b2, l1, f, 0), act_MoveTo(b3, l1, f, 0), act_MoveTo(b1, l2, f, 0), act_MoveTo(b2, l2, f, 0), act_MoveTo(b3, l2, f, 0)

```

state:  fl_TopClear(b,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,
b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above
(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,
b3,f,0),fl_OnTopOf(b3,b3,f,0)
action: act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,
l2,f,0),act_MoveTo(b2,l2,f,0)

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```
state:  fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
action: act_StackOn(b2,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0),act_MoveTo(b3,l2,f,0)
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state:  fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
action: act_MoveTo(b1,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b2,l2,f,0),act_MoveTo(b3,l2,f,0)

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```
state: f1_TopClear(b1, f, 0), f1_TopClear(b2, f, 0), f1_TopClear(b3, t, 0), f1_Above(b3, b1, t, 0), f1_OnTopOf(b3, b1, t, 0), f1_Above(b1, b2, t, 0), f1_OnTopOf(b1, b2, t, 0), f1_Above(b3, b2, t, 0), f1_At(b1, l1, 0), f1_At(b2, l1, 0), f1_At(b3, l1, 0), f1_Above(b1, b1, f, 0), f1_Above(b2, b1, f, 0), f1_Above(b2, b2, f, 0), f1_Above(b1, b3, f, 0), f1_Above(b2, b3, f, 0), f1_Above(b3, b3, f, 0), f1_GoalNotAchieved(t, 0), f1_OnTopOf(b1, b1, f, 0), f1_OnTopOf(b2, b1, f, 0), f1_OnTopOf(b2, b2, f, 0), f1_OnTopOf(b3, b2, f, 0), f1_OnTopOf(b1, b3, f, 0), f1_OnTopOf(b2, b3, f, 0), f1_OnTopOf(b3, b3, f, 0)
```

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t
,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,
b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(
b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,
b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

----- Time step 2 -----:

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t
,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t
,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

b2,b2,f,0), fl_Above(b3,b2,f,0), fl_Above(b2,b3,f,0), fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0), fl_OnTopOf(b3,
 b1,f,0), fl_OnTopOf(b1,b2,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b3,b2,f,0),
 fl_OnTopOf(b2,b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0), act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0), act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(
 b3,b2,f,0), act_StackOn(b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,11,f,0), act_MoveTo(b2,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0), fl_TopClear(b2,f,0), fl_TopClear(b3,t,0), fl_Above(b3,b2,t,
 0), fl_OnTopOf(b3,b2,t,0), fl_At(b1,12,0), fl_At(b2,12,0), fl_At(b3,12,0), fl_Above(
 b1,b1,f,0), fl_Above(b2,b1,f,0), fl_Above(b3,b1,f,0), fl_Above(b1,b2,f,0), fl_Above(
 b2,b2,f,0), fl_Above(b1,b3,f,0), fl_Above(b2,b3,f,0), fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0), fl_OnTopOf(b3,
 b1,f,0), fl_OnTopOf(b1,b2,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0), act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0), act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(
 b3,b2,f,0), act_StackOn(b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,11,f,0), act_MoveTo(b2,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0), fl_TopClear(b2,f,0), fl_TopClear(b3,t,0), fl_Above(b1,b2,t,
 0), fl_OnTopOf(b1,b2,t,0), fl_At(b1,12,0), fl_At(b2,12,0), fl_At(b3,12,0), fl_Above(
 b1,b1,f,0), fl_Above(b2,b1,f,0), fl_Above(b3,b1,f,0), fl_Above(b2,b2,f,0), fl_Above(
 b3,b2,f,0), fl_Above(b1,b3,f,0), fl_Above(b2,b3,f,0), fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0), fl_OnTopOf(b3,
 b1,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b3,b2,f,0), fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0), act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0), act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(
 b3,b2,f,0), act_StackOn(b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,11,f,0), act_MoveTo(b2,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0), fl_TopClear(b2,f,0), fl_TopClear(b3,f,0), fl_Above(b1,b2,t,
 0), fl_Above(b3,b2,t,0), fl_OnTopOf(b3,b2,t,0), fl_Above(b1,b3,t,0), fl_OnTopOf(b1,
 b3,t,0), fl_At(b1,12,0), fl_At(b2,12,0), fl_At(b3,12,0), fl_Above(b1,b1,f,0), fl_Above(
 b2,b1,f,0), fl_Above(b3,b1,f,0), fl_Above(b2,b2,f,0), fl_Above(b2,b3,f,0), fl_Above(
 b3,b3,f,0), fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0),
 fl_OnTopOf(b3,b1,f,0), fl_OnTopOf(b1,b2,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b2,
 b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,11,t,0), act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0), act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(
 b3,b2,f,0), act_StackOn(b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,11,f,0), act_MoveTo(b2,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0)

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,
b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above
(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,
b3,f,0),fl_OnTopOf(b3,b3,f,0)
action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t
,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,
b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above
(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,
b3,f,0),fl_OnTopOf(b3,b3,f,0)
action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,
b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above
(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(
b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),
fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,
b3,f,0),fl_OnTopOf(b3,b3,f,0)
action: act_MoveTo(b3,11,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t
,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3
,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1
,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3
,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t
,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,12,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),
 fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
 b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
 b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
 fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
 b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
 act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
 12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,
 0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
 b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
 b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,
 b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
 12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t,
 0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
 b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
 b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
 b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
 act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
 b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
 act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
 12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),
 fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
 b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
 b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
 fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
 b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b2,b1,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l2,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1
,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t
,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l2,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3
,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,l1,0),
fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3
,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),
act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t
,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0)

act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b2,b3,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

----- Time step 3 ----- :

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t,
0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t,
0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t,
0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0)

b2,b2,f,0), fl_Above(b1,b3,f,0), fl_Above(b2,b3,f,0), fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0), fl_OnTopOf(b3,
 b1,f,0), fl_OnTopOf(b1,b2,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0), act_StackOn(b3,b1,f,0),
 act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(b3,b2,f,0), act_StackOn(
 b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0), act_MoveTo(b1,11,f,0),
 act_MoveTo(b2,11,f,0), act_MoveTo(b3,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0), fl_TopClear(b2,f,0), fl_TopClear(b3,t,0), fl_Above(b1,b2,t,
 0), fl_OnTopOf(b1,b2,t,0), fl_At(b1,12,0), fl_At(b2,12,0), fl_At(b3,12,0), fl_Above(
 b1,b1,f,0), fl_Above(b2,b1,f,0), fl_Above(b3,b1,f,0), fl_Above(b2,b2,f,0), fl_Above(
 b3,b2,f,0), fl_Above(b1,b3,f,0), fl_Above(b2,b3,f,0), fl_Above(b3,b3,f,0),
 fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0), fl_OnTopOf(b3,
 b1,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b3,b2,f,0), fl_OnTopOf(b1,b3,f,0),
 fl_OnTopOf(b2,b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0), act_StackOn(b3,b1,f,0),
 act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(b3,b2,f,0), act_StackOn(
 b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0), act_MoveTo(b1,11,f,0),
 act_MoveTo(b2,11,f,0), act_MoveTo(b3,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0), fl_TopClear(b2,f,0), fl_TopClear(b3,f,0), fl_Above(b1,b2,t,
 0), fl_Above(b3,b2,t,0), fl_OnTopOf(b3,b2,t,0), fl_Above(b1,b3,t,0), fl_OnTopOf(b1,
 b3,t,0), fl_At(b1,12,0), fl_At(b2,12,0), fl_At(b3,12,0), fl_Above(b1,b1,f,0), fl_Above(
 b2,b1,f,0), fl_Above(b3,b1,f,0), fl_Above(b2,b2,f,0), fl_Above(b2,b3,f,0), fl_Above(
 b3,b3,f,0), fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0),
 fl_OnTopOf(b3,b1,f,0), fl_OnTopOf(b1,b2,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b2,
 b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0), act_StackOn(b3,b1,f,0),
 act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(b3,b2,f,0), act_StackOn(
 b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0), act_MoveTo(b1,11,f,0),
 act_MoveTo(b2,11,f,0), act_MoveTo(b3,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0), fl_TopClear(b2,f,0), fl_TopClear(b3,f,0), fl_Above(b1,b2,t,
 0), fl_OnTopOf(b1,b2,t,0), fl_Above(b1,b3,t,0), fl_Above(b2,b3,t,0), fl_OnTopOf(b2,
 b3,t,0), fl_At(b1,12,0), fl_At(b2,12,0), fl_At(b3,12,0), fl_Above(b1,b1,f,0), fl_Above(
 b2,b1,f,0), fl_Above(b3,b1,f,0), fl_Above(b2,b2,f,0), fl_Above(b3,b2,f,0), fl_Above(
 b3,b3,f,0), fl_GoalNotAchieved(f,0), fl_OnTopOf(b1,b1,f,0), fl_OnTopOf(b2,b1,f,0),
 fl_OnTopOf(b3,b1,f,0), fl_OnTopOf(b2,b2,f,0), fl_OnTopOf(b3,b2,f,0), fl_OnTopOf(b1,
 b3,f,0), fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b1,f,0), act_StackOn(b2,b1,f,0), act_StackOn(b3,b1,f,0),
 act_StackOn(b1,b2,f,0), act_StackOn(b2,b2,f,0), act_StackOn(b3,b2,f,0), act_StackOn(
 b1,b3,f,0), act_StackOn(b2,b3,f,0), act_StackOn(b3,b3,f,0), act_MoveTo(b1,11,f,0),
 act_MoveTo(b2,11,f,0), act_MoveTo(b3,11,f,0), act_MoveTo(b1,12,f,0), act_MoveTo(b2,
 12,f,0), act_MoveTo(b3,12,f,0)

act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(f,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t
,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,12,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1
,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,12,0),
fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3
,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t
,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,12,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1
,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t
,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,12,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,l1,0),
fl_At(b2,l2,0),fl_At(b3,l2,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t,
0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l2,0),fl_At(b3,l2,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),
fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t,
0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,l1,0),fl_At(b2,l2,0),fl_At(b3,l2,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,
b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b2,
l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,l1,0),
fl_At(b2,l2,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,
b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),

act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,11,0),fl_At(b2,12,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_MoveTo(b3,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)
 action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b1,b2,t
,0),fl_OnTopOf(b1,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,12,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(
b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3
,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),
act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(
b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),
act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_At(b1,11,0),
fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3
,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,
b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),
fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,
b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b2,t
,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),
fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3
,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),
fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),
act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(
b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),
act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,
12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,t,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b3,t
,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(
b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(
b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),

state: fl_TopClear(b1,t,0),fl_TopClear(b2,f,0),fl_TopClear(b3,f,0),fl_Above(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0),act_MoveTo(b3,l2,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b1,b3,t,0),fl_OnTopOf(b1,b3,t,0),fl_Above(b2,b3,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b3,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b3,l2,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0),act_MoveTo(b2,l1,f,0),act_MoveTo(b3,l1,f,0),act_MoveTo(b1,l2,f,0),act_MoveTo(b2,l2,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_At(b1,l1,0),fl_At(b2,l1,0),fl_At(b3,l1,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,l1,f,0)

act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b2,b1,t,0),fl_OnTopOf(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_Above(b3,b2,t,0),fl_OnTopOf(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b3,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,f,0),fl_TopClear(b3,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b1,b2,t,0),fl_OnTopOf(b1,b2,t,0),fl_Above(b3,b2,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b2,b1,f,0),fl_Above(b2,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b2,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b2,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b2,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b1,12,f,0),act_MoveTo(b3,12,f,0)

state: fl_TopClear(b1,f,0),fl_TopClear(b2,t,0),fl_TopClear(b3,f,0),fl_Above(b2,b1,t,0),fl_Above(b3,b1,t,0),fl_OnTopOf(b3,b1,t,0),fl_Above(b2,b3,t,0),fl_OnTopOf(b2,b3,t,0),fl_At(b1,11,0),fl_At(b2,11,0),fl_At(b3,11,0),fl_Above(b1,b1,f,0),fl_Above(b1,b2,f,0),fl_Above(b2,b2,f,0),fl_Above(b3,b2,f,0),fl_Above(b1,b3,f,0),fl_Above(b3,b3,f,0),fl_GoalNotAchieved(t,0),fl_OnTopOf(b1,b1,f,0),fl_OnTopOf(b2,b1,f,0),fl_OnTopOf(b1,b2,f,0),fl_OnTopOf(b2,b2,f,0),fl_OnTopOf(b3,b2,f,0),fl_OnTopOf(b1,b3,f,0),fl_OnTopOf(b3,b3,f,0)

action: act_MoveTo(b1,12,t,0),act_StackOn(b1,b1,f,0),act_StackOn(b2,b1,f,0),act_StackOn(b3,b1,f,0),act_StackOn(b1,b2,f,0),act_StackOn(b2,b2,f,0),act_StackOn(b3,b2,f,0),act_StackOn(b1,b3,f,0),act_StackOn(b2,b3,f,0),act_StackOn(b3,b3,f,0),act_MoveTo(b1,11,f,0),act_MoveTo(b2,11,f,0),act_MoveTo(b3,11,f,0),act_MoveTo(b2,12,f,0),act_MoveTo(b3,12,f,0)

lpmln solving time: 1.72479987144
MDP solving time: 0.00124597549438