

Assignment 1020

1 Problem 1

1. T

2. T

3. 否定。考虑表达式 $e = e_1 - e_2 = 2^{63} - 1$. $\text{constant_fold}(e) = \llbracket 2^{63} - 1 \rrbracket = \{(s, 2^{63} - 1) \mid s \in \text{state}\}$.

而 $\llbracket e \rrbracket = \llbracket e_1 - e_2 \rrbracket = \{(s, n_1 - n_2) \mid (s, n_1) \in \llbracket e_1 \rrbracket, (s, n_2) \in \llbracket e_2 \rrbracket, -2^{63} \leq n_1 - n_2 \leq 2^{63} - 1\}$ 。由于 $\llbracket e_1 \rrbracket = \llbracket 2^{63} \rrbracket = \emptyset$, 所以 $\llbracket e \rrbracket = \emptyset$, 从而 $\text{constant_fold}(e)$ 与 e 不语义等价

4. 不能做编译优化，因为其改变了语义！

2 Problem 2

定义:

ϵ : 空字符串

$\text{len}(l)$: 字符串的长度

l_1, l_2 : 表示将两个字符串拼接在一起

- $\llbracket n \rrbracket = \{(s, \epsilon, n) \mid s \in \text{state}, l \in (Z_{64})^*\}$ 如果 $-2^{63} \leq n \leq 2^{63} - 1$
- $\llbracket n \rrbracket = \emptyset$ 如果不满足 $-2^{63} \leq n \leq 2^{63} - 1$
- $\llbracket x \rrbracket = \{(s, \epsilon, s(x)) \mid s \in \text{state}\}$
- $\llbracket \text{read_int}() \rrbracket = \{(s, l, l[0]) \mid s \in \text{state}, l \in (Z_{2^{64}})^*, \text{len}(l) = 1\}$, $l[0]$ 表示 l 中的第一个数
- $\llbracket e_1 + e_2 \rrbracket = \{(s, (l_1, l_2), n_1 + n_2) \mid (s, l_1, n_1) \in \llbracket e_1 \rrbracket, (s, l_2, n_2) \in \llbracket e_2 \rrbracket, -2^{63} \leq n_1 + n_2 \leq 2^{63} - 1, l_1 \in (Z_{2^{64}})^*, l_2 \in (Z_{2^{64}})^*\}$
- $\llbracket e_1 - e_2 \rrbracket = \{(s, (l_1, l_2), n_1 - n_2) \mid (s, l_1, n_1) \in \llbracket e_1 \rrbracket, (s, l_2, n_2) \in \llbracket e_2 \rrbracket, -2^{63} \leq n_1 - n_2 \leq 2^{63} - 1, l_1 \in (Z_{2^{64}})^*, l_2 \in (Z_{2^{64}})^*\}$
- $\llbracket e_1 * e_2 \rrbracket = \{(s, (l_1, l_2), n_1 * n_2) \mid (s, l_1, n_1) \in \llbracket e_1 \rrbracket, (s, l_2, n_2) \in \llbracket e_2 \rrbracket, -2^{63} \leq n_1 * n_2 \leq 2^{63} - 1, l_1 \in (Z_{2^{64}})^*, l_2 \in (Z_{2^{64}})^*\}$