

PROBLEMS ON ATTRIBUTE GRAMMAR

1. Write attribute grammar for the following CFGs and construct parse tree attribute computation for val attribute for the strings.

$$(i) (4+5)*3 \quad (ii) 6*7+7$$

$$\text{exp} \rightarrow \text{exp} + \text{term} \mid \text{exp} \sim \text{term} \mid \text{term}$$

$$\text{term} \rightarrow \text{term} * \text{factor} \mid \text{factor}$$

$$\text{factor} \rightarrow (\text{exp}) \mid \text{number}$$

2. Write attribute grammar for the following GFG and construct parse tree with attribute computation for datatype attribute computation for datatype for data type the string.

$$(i) \text{int } x, y, z \quad (ii) \text{float } a, b$$

$$\text{decl} \rightarrow \text{type- var-list}$$

$$\text{type} \rightarrow \text{int} \mid \text{float}$$

$$\text{var-list} \rightarrow \text{id}, \text{var-list} \mid \text{id}$$

— X —

Solutions:Grammar Rule

$$1. \text{exp1} \rightarrow \text{exp2} + \text{term}$$

$$\text{exp1} \rightarrow \text{exp2} - \text{term}$$

$$\text{exp} \rightarrow \text{term}$$

$$\text{term1} \rightarrow \text{term2} * \text{factor}$$

$$\text{term} \rightarrow \text{factor}$$

$$\text{factor} \rightarrow (\text{exp})$$

$$\text{factor} \rightarrow \text{number}$$

Semantics Rules

$$\text{exp1.val} = \text{exp2.val} + \text{term.val}$$

$$\text{exp1.val} = \text{exp2.val} - \text{term.val}$$

$$\text{exp.val} = \text{term.val}$$

$$\text{term1.val} = \text{term2.val} * \text{factor.val}$$

$$\text{term.val} = \text{factor.val}$$

$$\text{factor.val} = \text{exp.val}$$

$$\text{factor.val} = \text{number.val}$$

Parse tree : $(4+5)*3$

$\exp \text{ val} = 27$

$\text{term. val} = 27$

$\text{term. val} = 9$

$\text{term. val} = 3$

$\text{factor. val} = 9$

$\text{factor. val} = 3$

$\text{exp. val} = 9$

$\text{exp. val} = 3$

Parse tree: $6 * 7 + 7$

(i) $\text{int } x, y, z$

$\text{type. val} = \text{int}$

$\text{var-list. val} = a, b$

$\text{var-list. val} = b$

Attribute grammar

$\text{decl. val} \rightarrow \text{type. val}$ var-list. val

$\text{type. val} \rightarrow \text{int. val}$

$\text{type. val} \rightarrow \text{float. val}$

$\text{var-list. val} \rightarrow \text{id. val}$, var-list. val

$\text{var-list. val} \rightarrow \text{id. val}$

2. CFG

$\text{decl} \rightarrow \text{type var-list}$

$\text{type} \rightarrow \text{int}$

$\text{type} \rightarrow \text{float}$

$\text{var-list} \rightarrow \text{id}, \text{var-list}$

$\text{var-list} \rightarrow \text{id}$

3. Write attribute grammar for the following CFG & construct parse tree with attribute comput'n for base and val attributes for strings

(i) 2340 (ii) 9670 (iii) 369d

based-num \rightarrow num based

basechar \rightarrow 0|1|2|3|4|5|6|7|8|9

num \rightarrow num.digit/digit

digit \rightarrow 0|1|2|3|4|5|6|7|8|9

CFG

based-num \rightarrow num based char

basechar \rightarrow 0

basechar \rightarrow d

num1 \rightarrow num2.digit

Attribute grammar

based_num.val = num.Val

num.base = base-char.base

basechar.base = 8

basechar.base = 10

① num1.val =

if (digit.val = error or
num2.val = error)

then num1.val = error

else

num2.val * num1.base +
digit.val

② num2.base = num1.base

digit.base = num1.base

num.val = digit.val

digit.base = num.base

digit.val = 0

digit.val = 1

digit.val = 2

digit.val = 3

digit.val = 4

digit.val = 5

digit.val = 6

digit.val = 7

digit.val = 8

digit.val = 9 if (digit.base = 8) error

else 8

num \rightarrow digit

digit \rightarrow 0

digit \rightarrow 1

digit \rightarrow 2

digit \rightarrow 3

digit \rightarrow 4

digit \rightarrow 5

digit \rightarrow 6

digit \rightarrow 7

digit \rightarrow 8

digit \rightarrow 9

CFG

Attribute

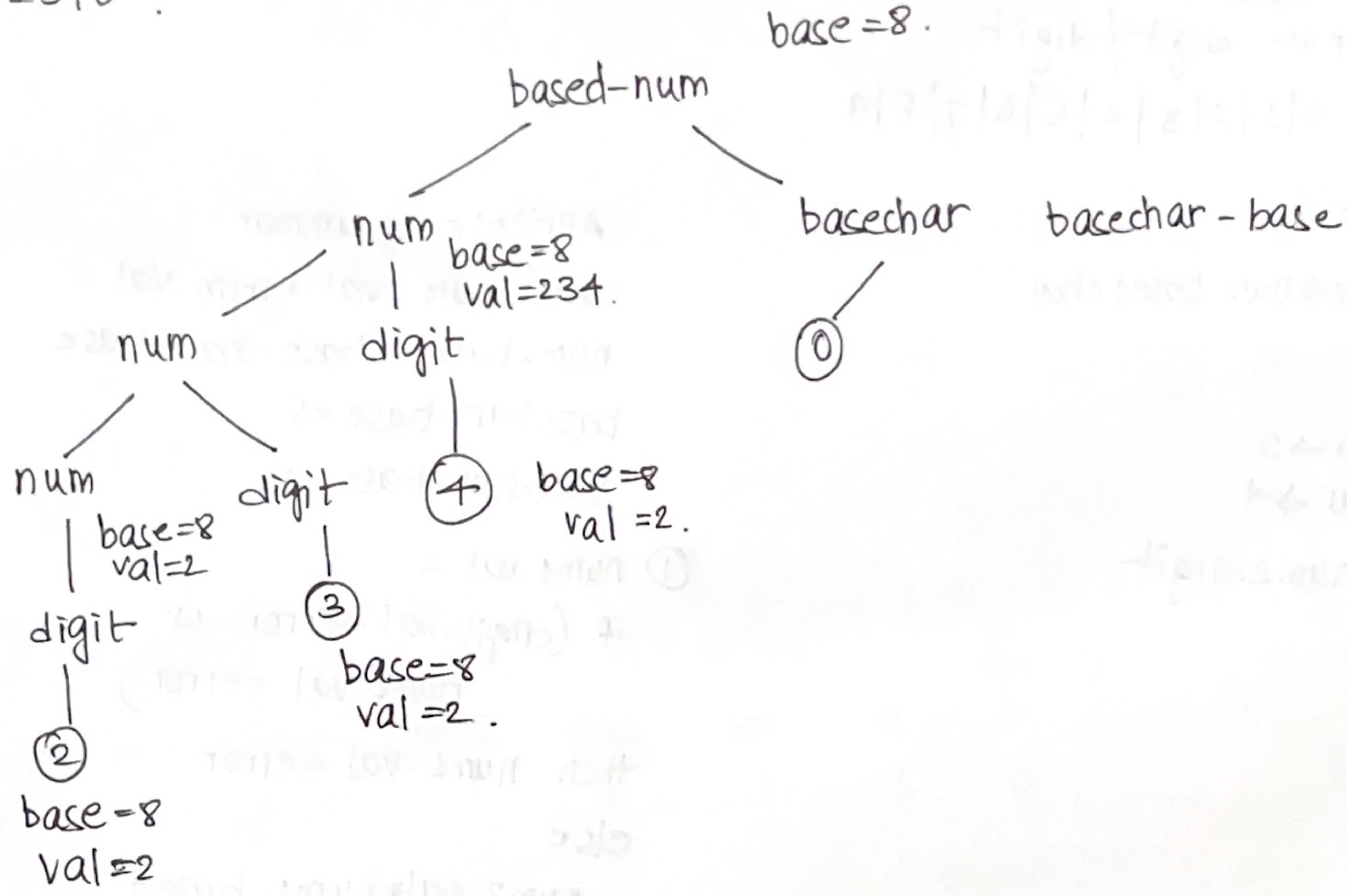
digit-val = if (digit-base = a)

error

else

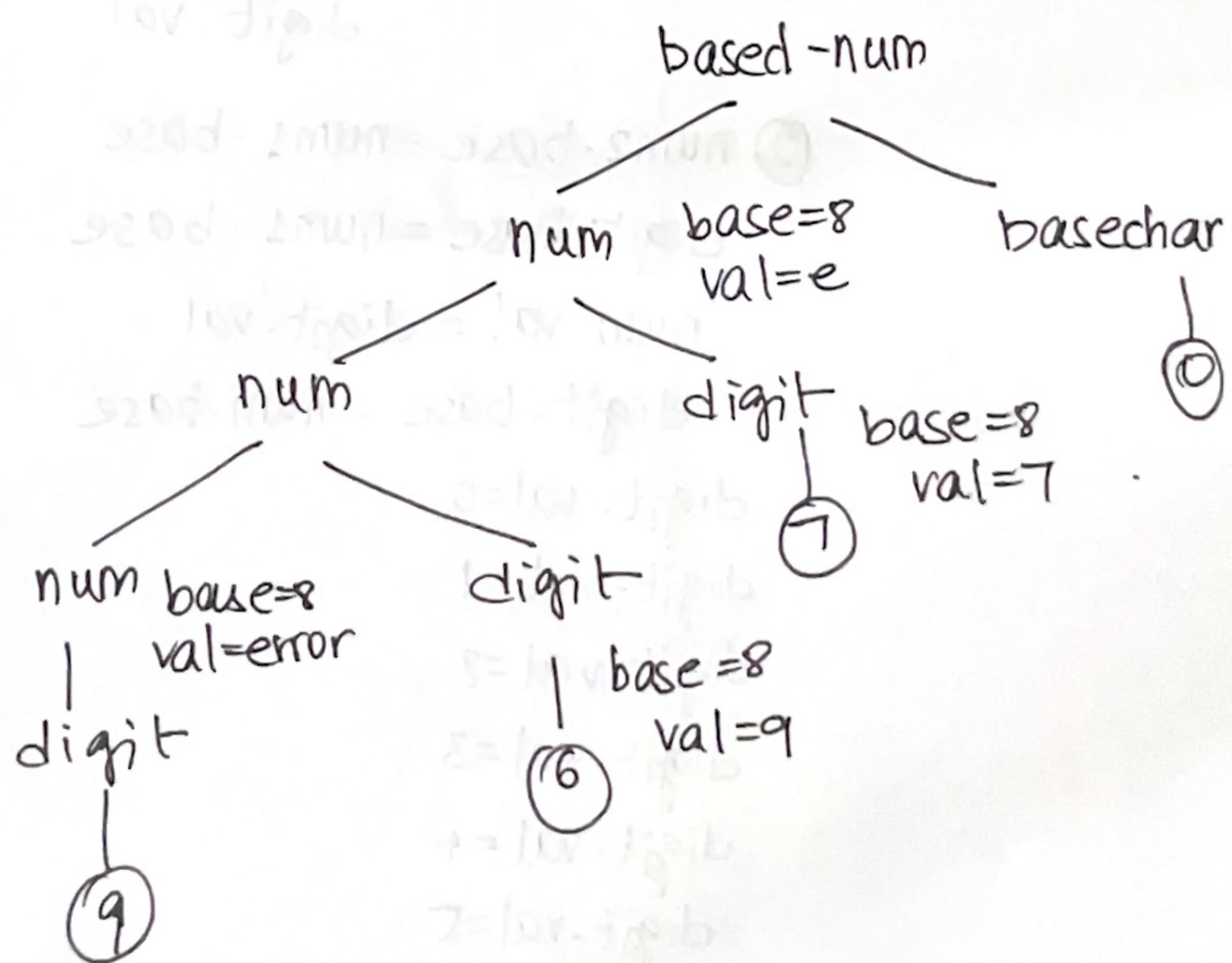
9

(i) 2340

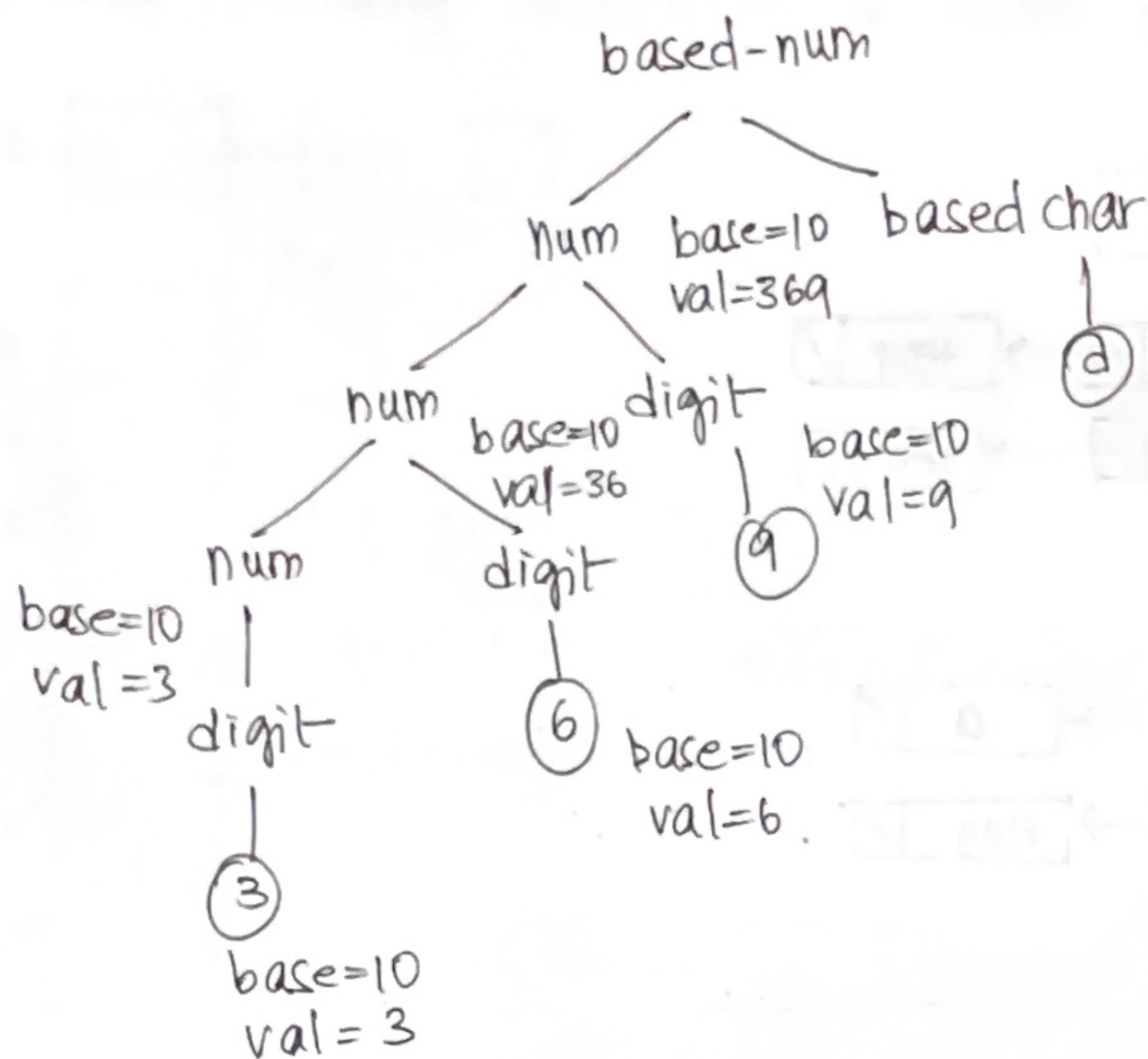


(i)

(ii)



(iii) 369d



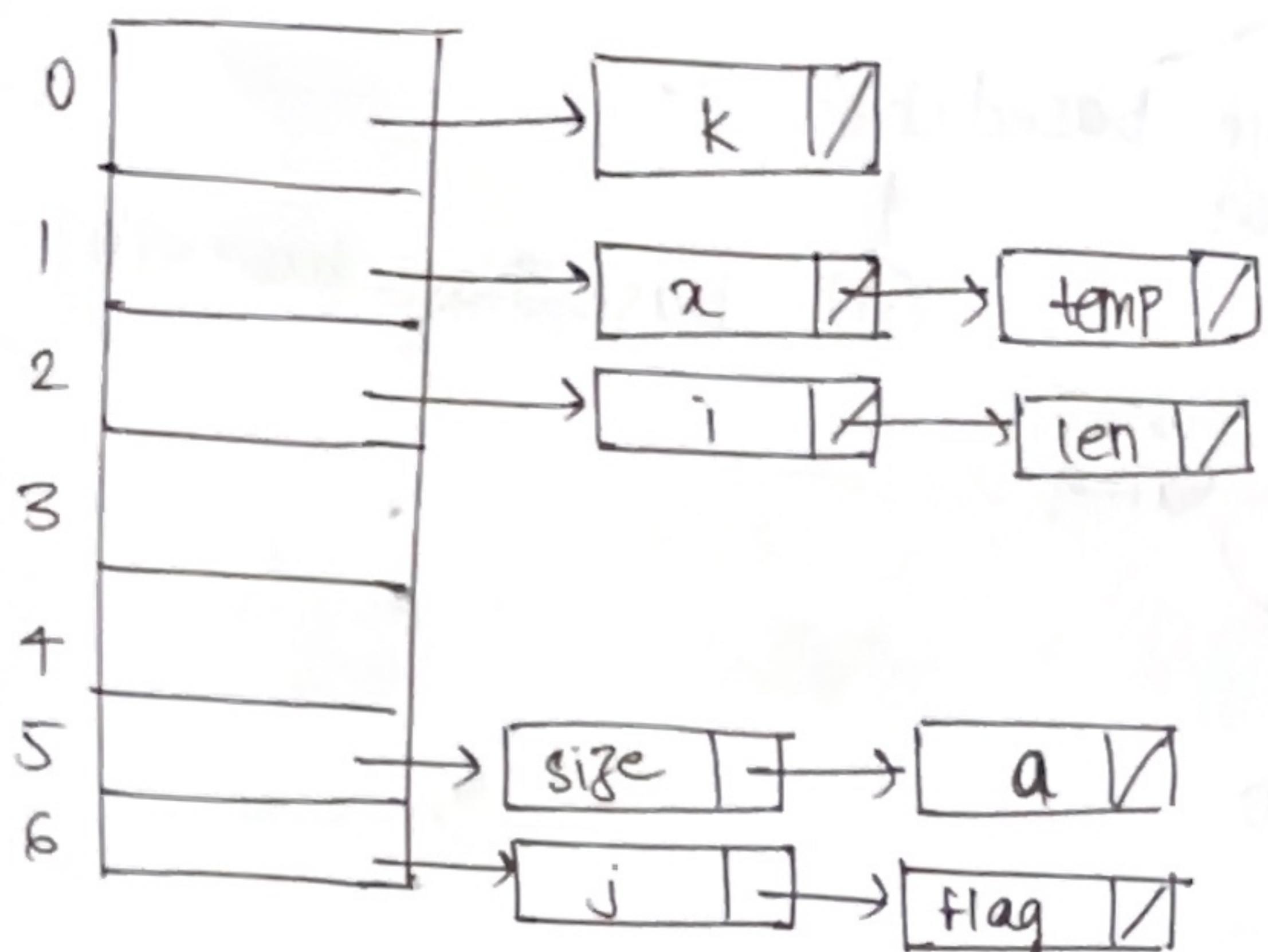
Problems on symbol table.

①	x	size	i	j	temp	flag	len	a	b
	1	5	2	6	1	6	2	1	0

(i) open addressing .

0	K
1	x
2	i
3	temp
4	len
5	size
6	j

(ii) separate chaining



$$\text{Hash}(y) = 25 \bmod 10 = 5$$

$$\text{Hash}(j) = 10 \bmod 10 = 0$$

$$\text{Hash}(\text{foo}) = (15+15+6) \bmod 10 = 6$$

$$\text{Hash}(x) = 24 \bmod 10 = 4$$

$$\text{Hash}(h) = 8 \bmod 10 = 8$$

$$\text{Hash}(A) = 1 \bmod 10 = 1$$

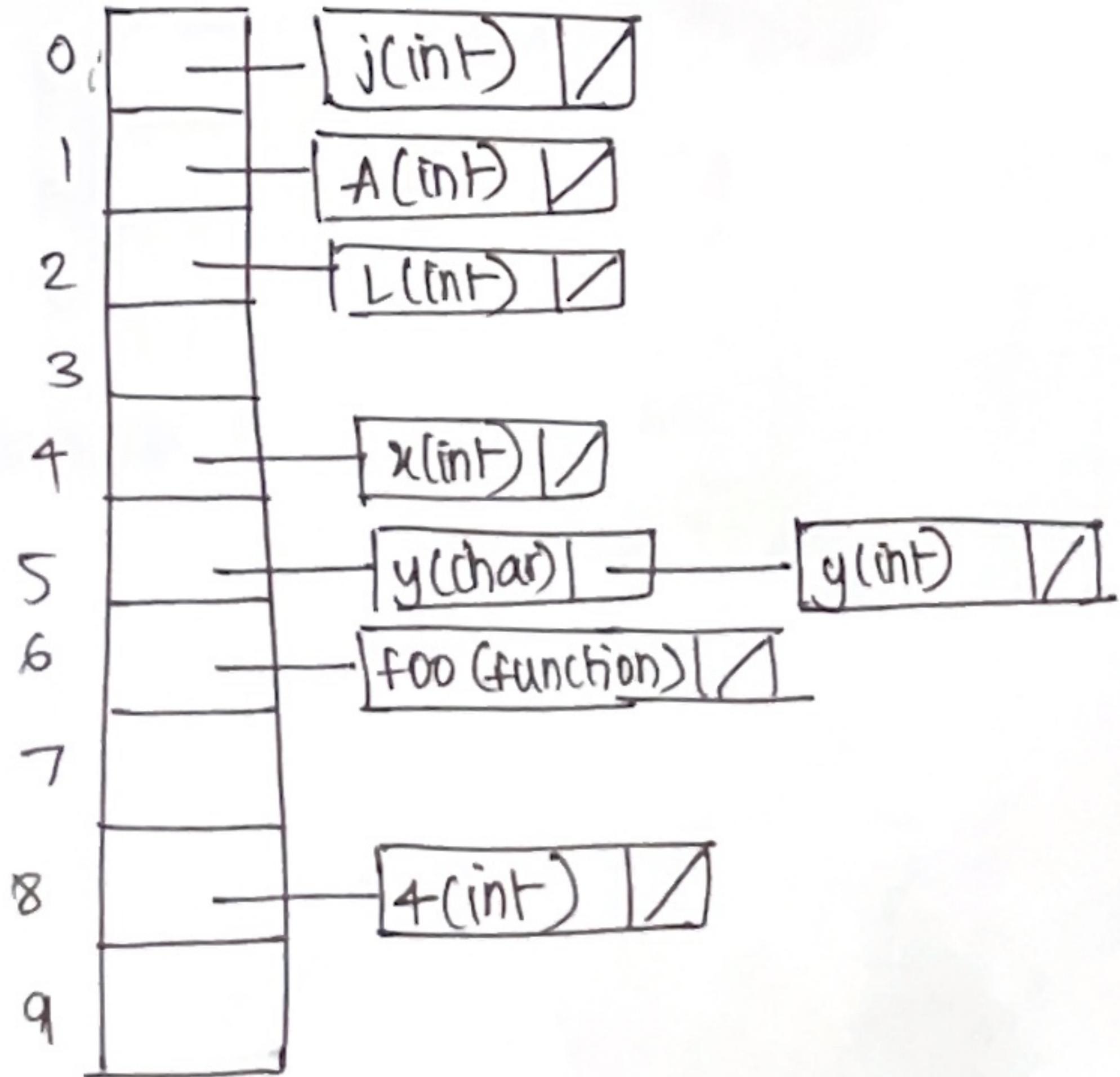
$$\text{Hash}(L) = 12 \bmod 10 = 2$$

$$\text{Hash}(C) = 3 \bmod 10 = 3$$

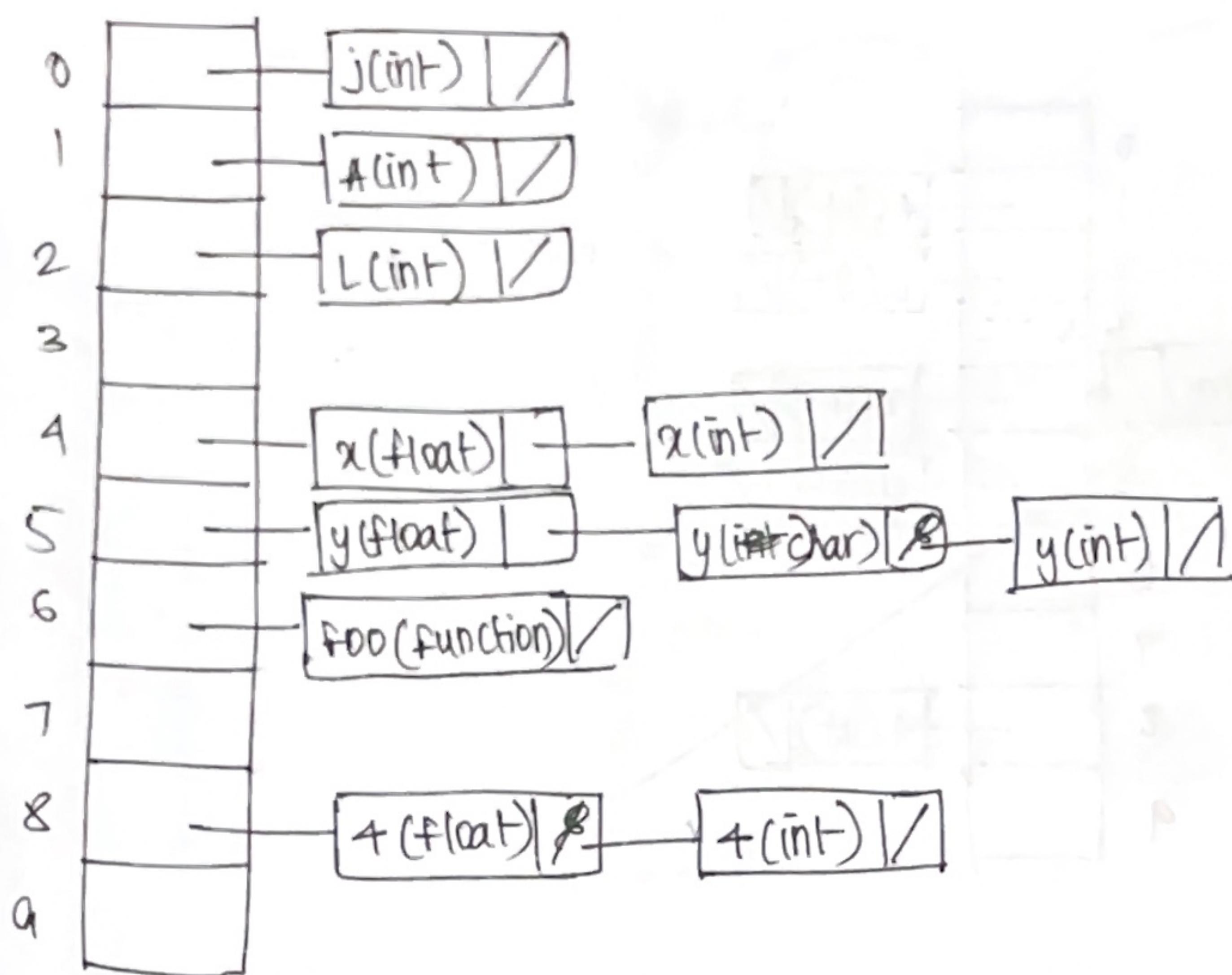
$$\text{Hash}(M) = 13 \bmod 10 = 3$$

(a)

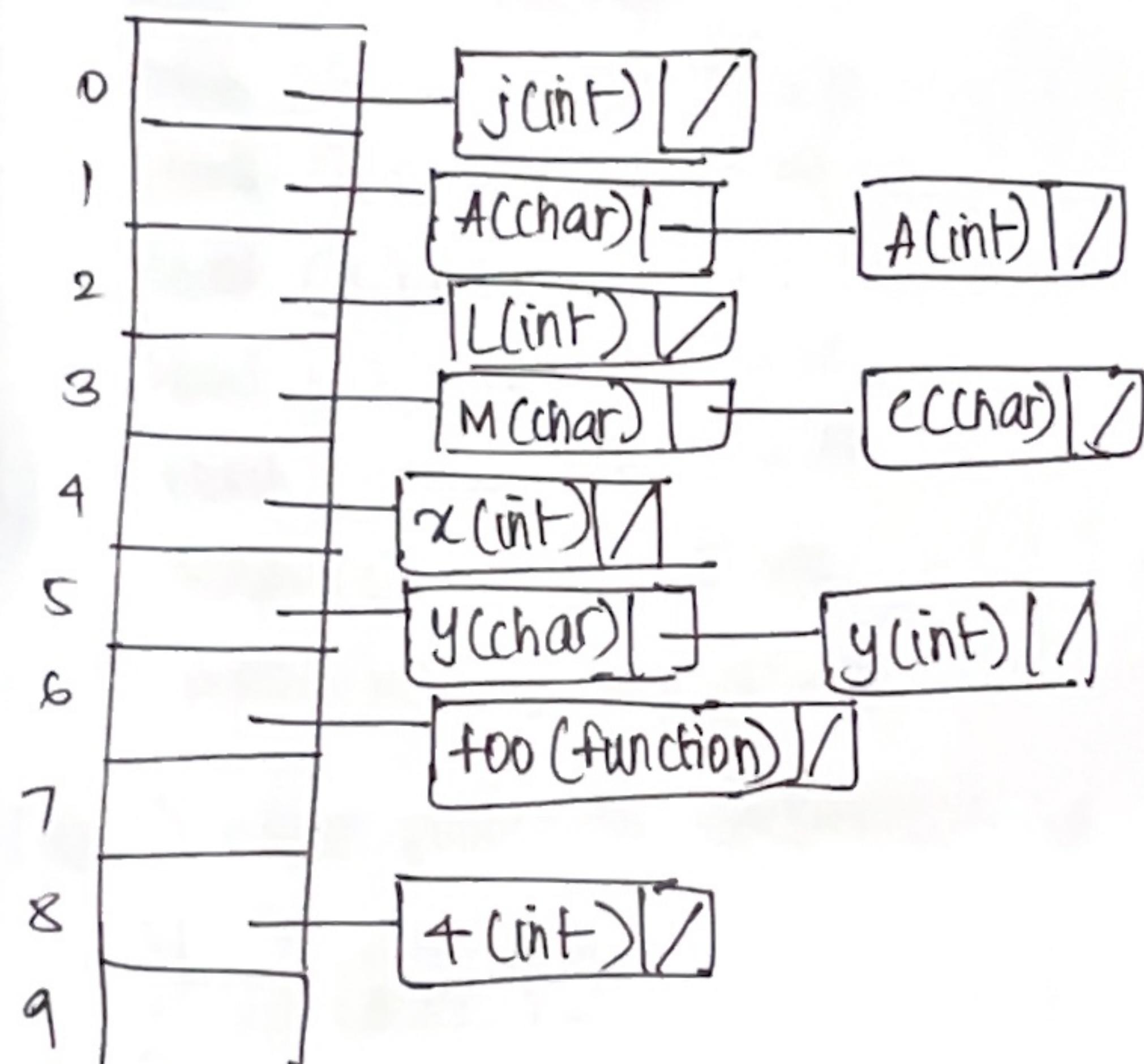
(i) After proceeding the declarations of body of foo .



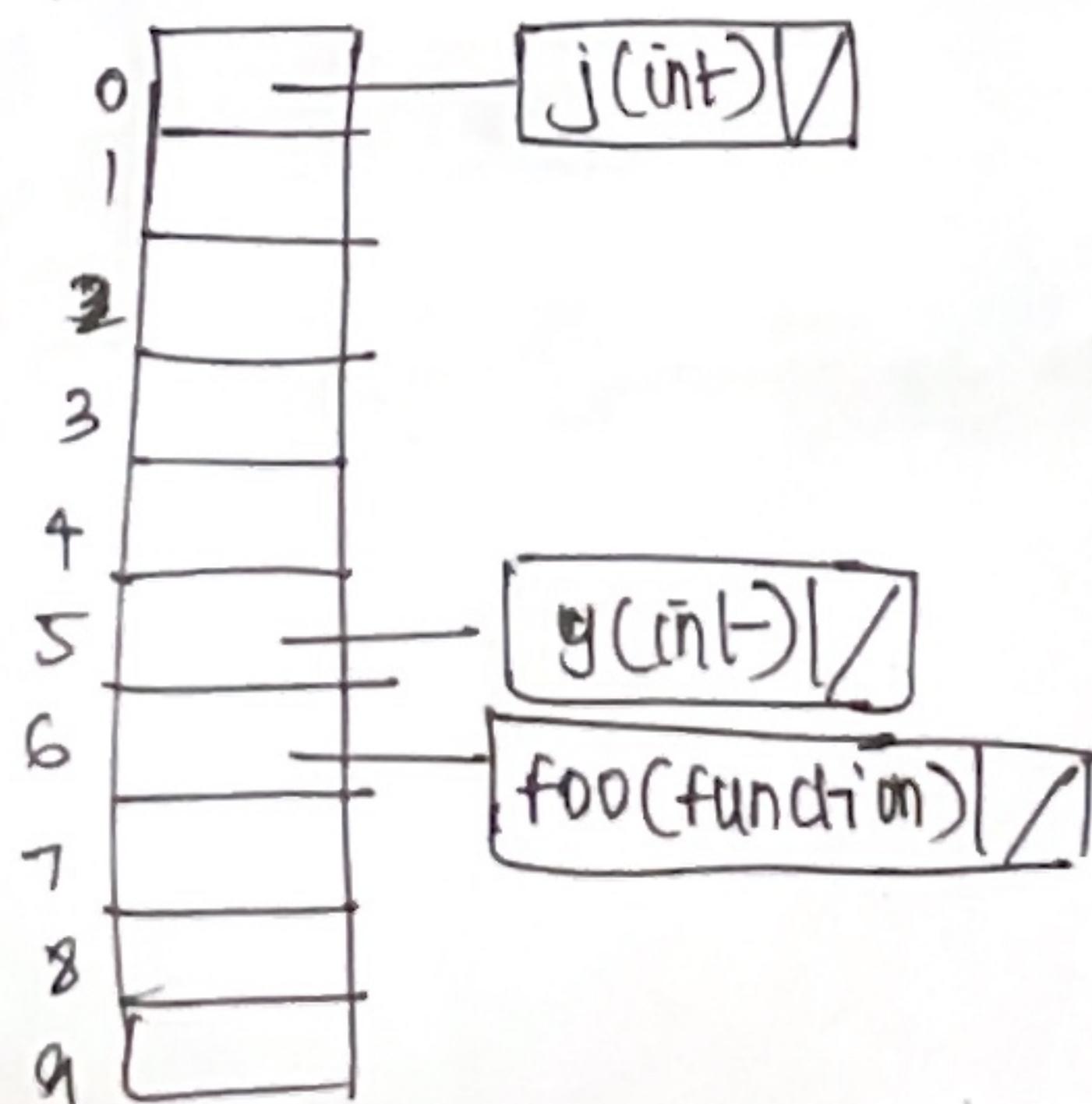
(b) After processing declaration of nested compound statement



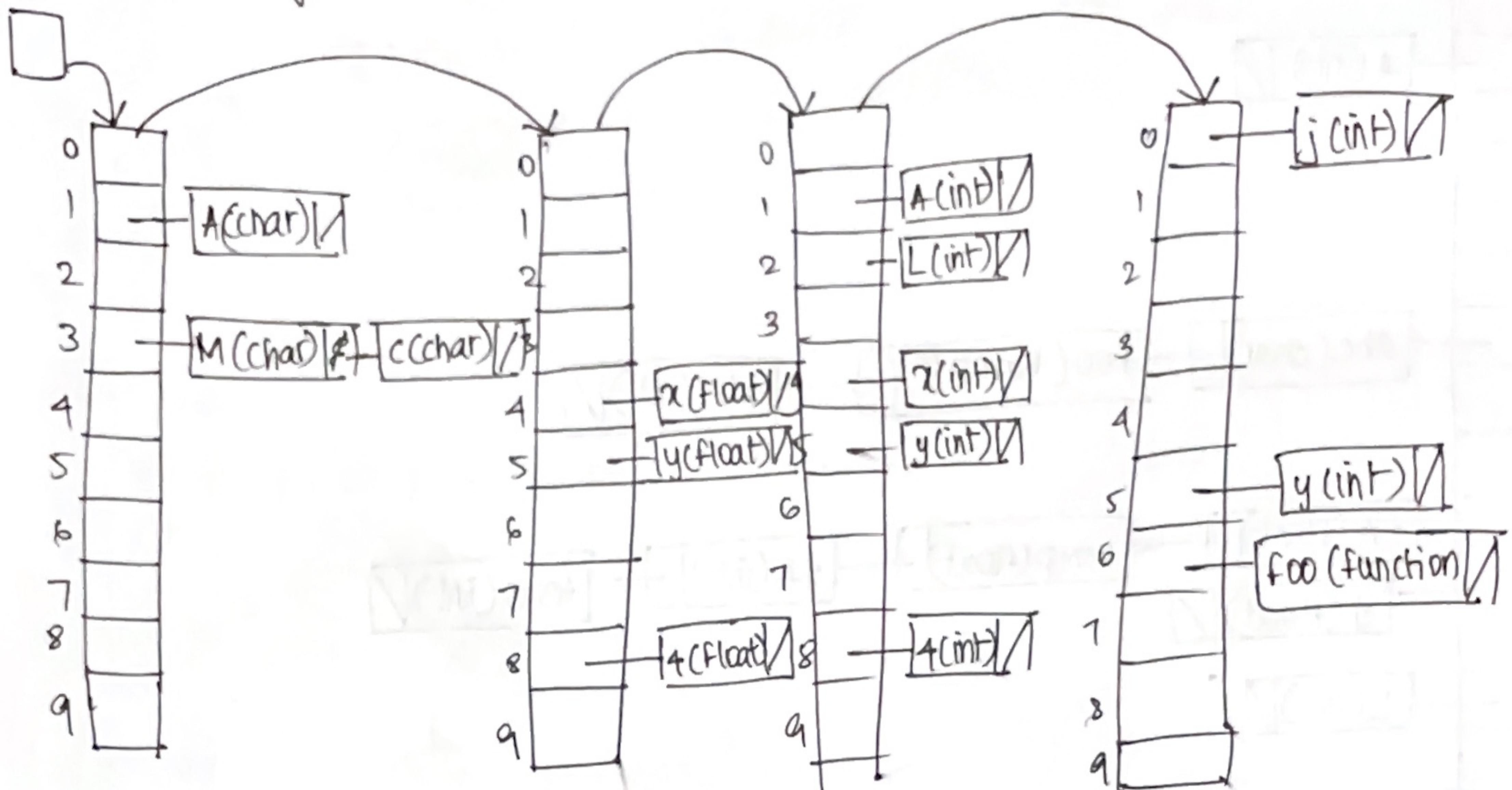
(c) After processing declaration of second nested block of function foo.



(iv) End of function foo



(b) separate symbol table.



$$2. \text{ Hash(temp)} = 54 \bmod 15 = 9$$

$$\text{Hash(abc)} = 6 \bmod 15 = 6$$

$$\text{Hash(foo)} = 36 \bmod 15 = 6$$

$$\text{Hash(bac)} = 6 \bmod 15 = 6$$

$$\text{Hash(4A)} = 9 \bmod 15 = 9$$

$$\text{Hash(x)} = 1 \bmod 15 = 1$$

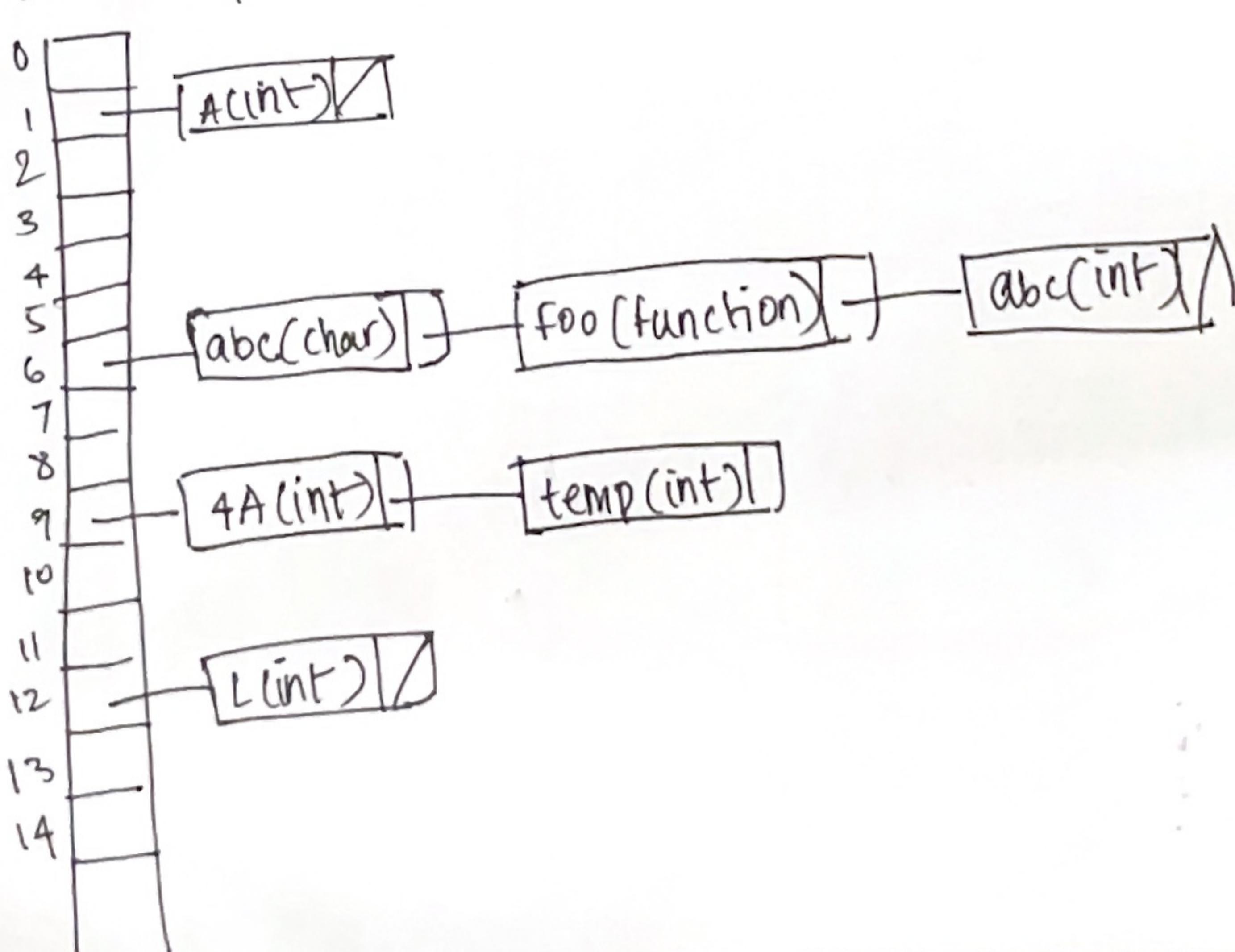
$$\text{Hash(L)} = 12 \bmod 15 = 12$$

$$\text{Hash(y)} = 25 \bmod 15 = 10$$

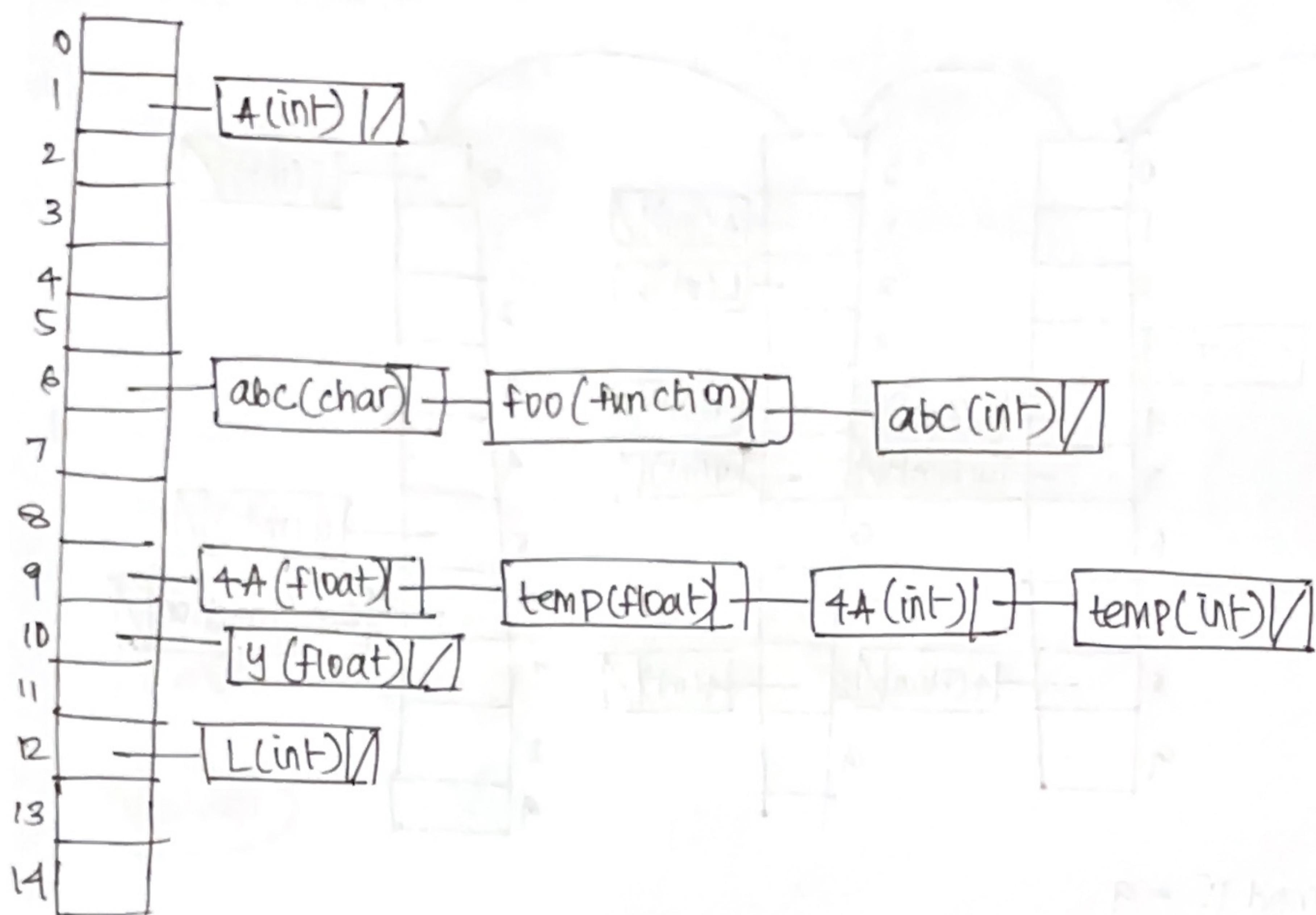
$$\text{Hash(c)} = 8 \bmod 15 = 3$$

$$\text{Hash(M)} = 13 \bmod 15 = 13$$

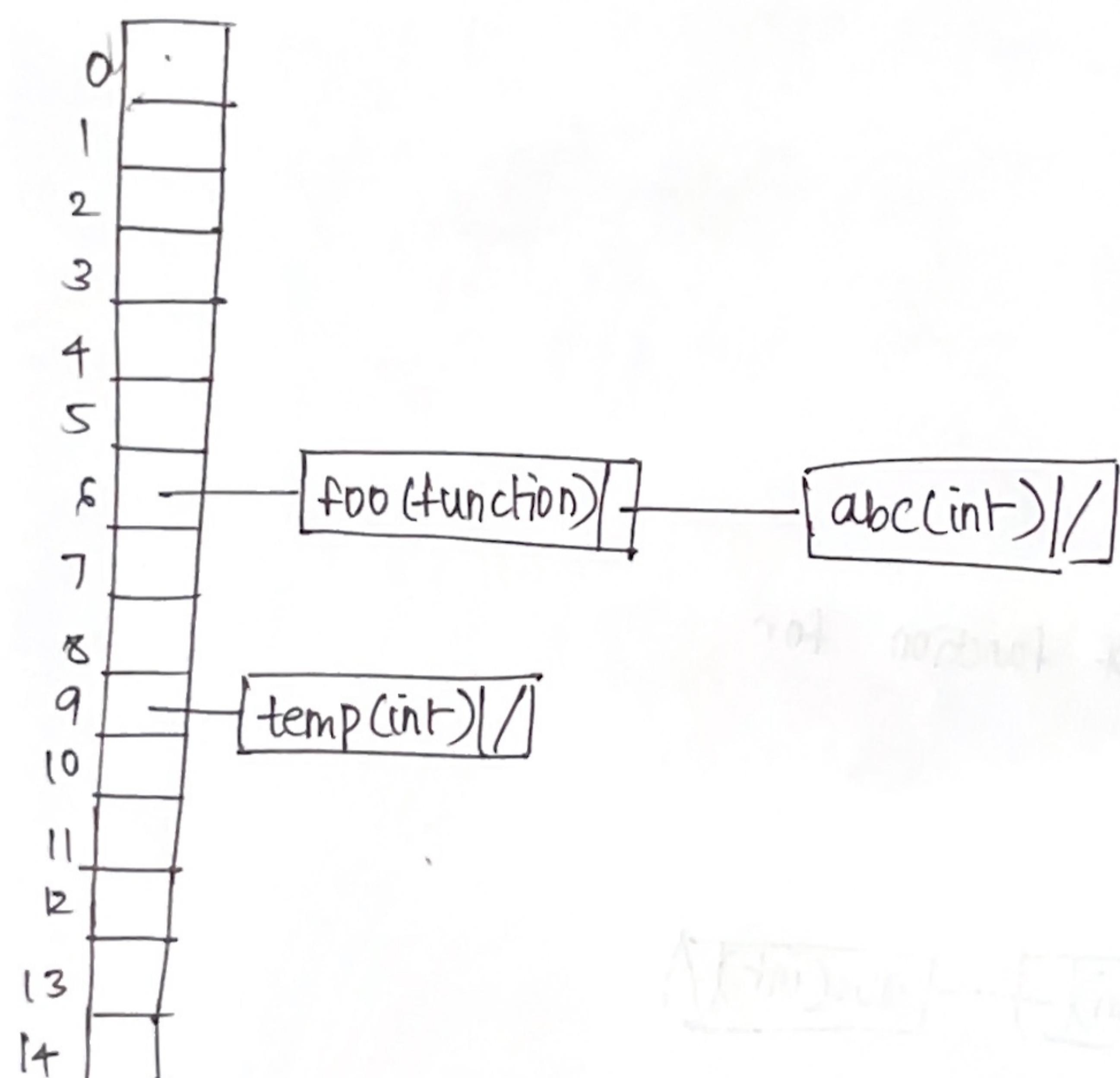
(a) i) After processing declaration of function for



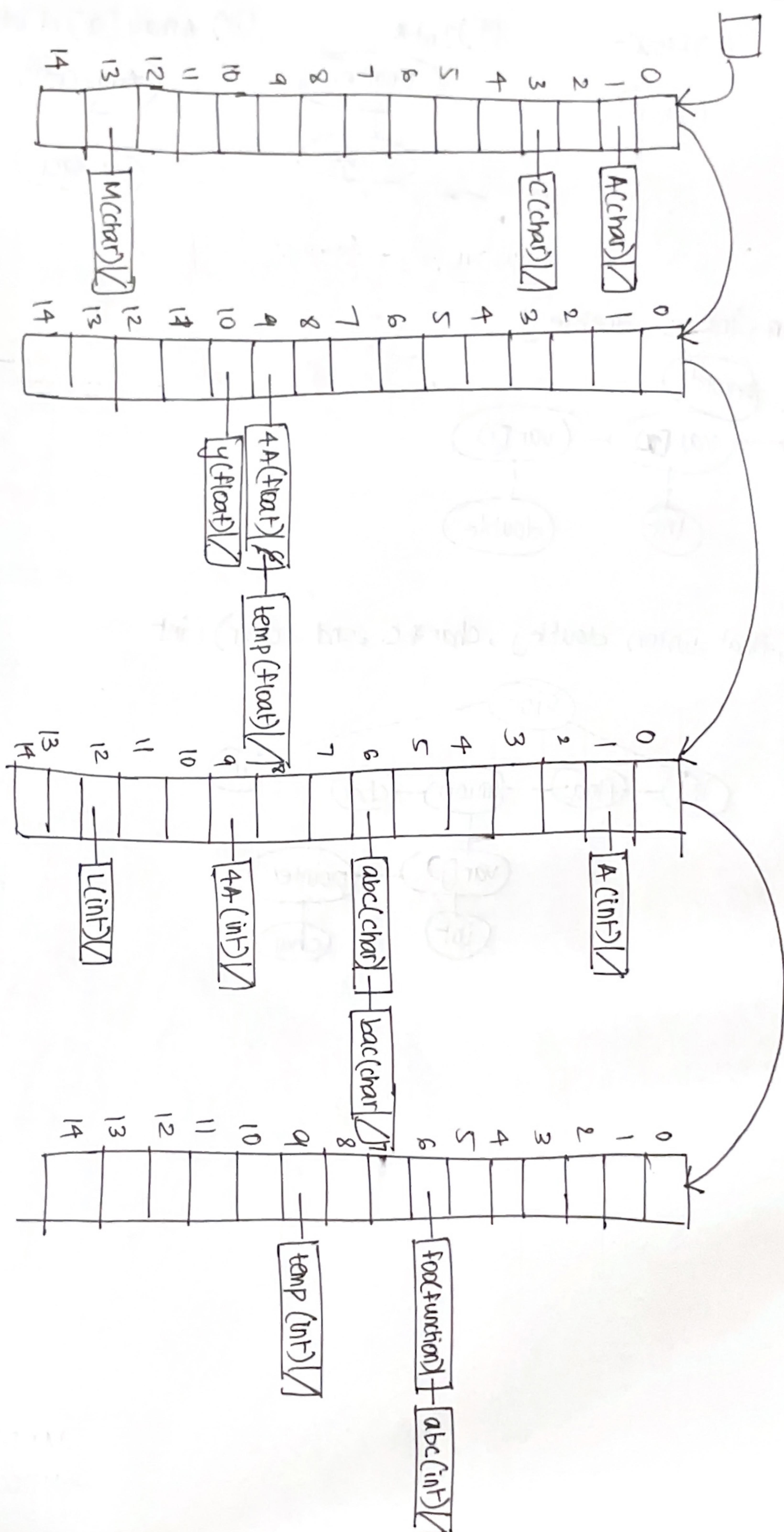
(ii) After processing declaration of first nested block of function foo



(iv) End of function foo.

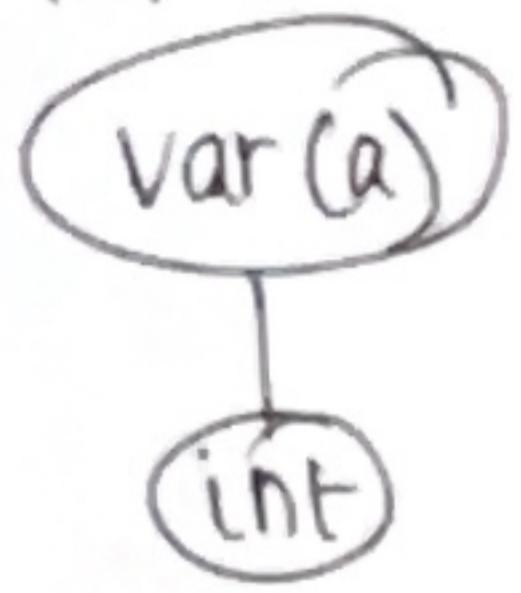


(b) Separate symbol table (with separate list chain method) for each scope

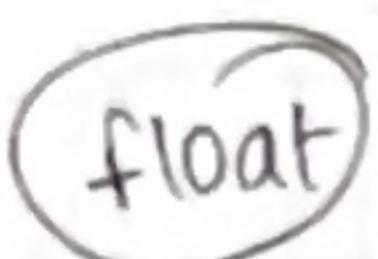


Find tree structure for the following

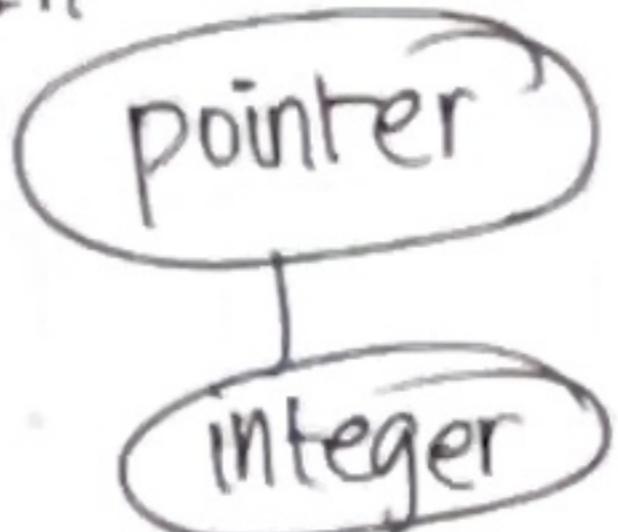
(i) int a



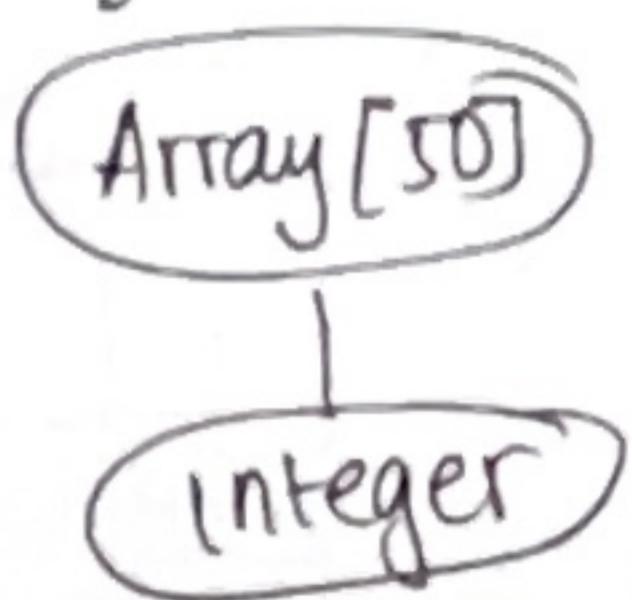
(ii) float



(iii) Int*



(iv) Array [50] of integer



(v) Record

Boolean n, int x, double j

end



(vi) proc (int, float, union double j, char * c, end, char) : int

