

Lab 3: C String Library Routines

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Types

The following types are declared:

- $\text{Addr} == \mathbf{N}$
- $\text{maxaddr}, \text{minaddr}: \text{Addr}$
- $\text{Store} == \text{Addr} \rightarrow \text{Char}$
- $\text{Terms} == \text{PChar}$ [the set of all terminating characters]

Predefined Functions

We assume that the following functions are predefined and declared:

- seq is predefined as:
 $\text{seq } X == \{f: \mathbf{N} \rightarrow X \mid \text{dom } f = 1 \dots \#f\}$
- min takes a set of \mathbf{N} and returns the smallest element of that set.

strcat & strncpy (pre/post)

strcat (s1:Addr, s2:Addr)

```
pre   terms( $\sigma$ ,s1)  $\neq \emptyset$ 
      terms( $\sigma$ ,s2)  $\neq \emptyset$ 
      n > 0
      {s1..min terms( $\sigma$ ,s1)}  $\cap$  {s2..min terms( $\sigma$ ,s2)}  $\neq \emptyset$ 
post  string( $\sigma'$ ,s1) = seq[s1..min terms( $\sigma$ ,s1)-1]  $\cap$ 
      string( $\sigma$ ,s2)
      terms( $\sigma'$ ,s1)  $\neq \emptyset$ 
```

strncpy (s1:Addr, s2:Addr, n:int)

```
pre   terms( $\sigma$ ,s1)  $\neq \emptyset$ 
      terms( $\sigma$ ,s2)  $\neq \emptyset$ 
      n > 0
      {s1..min terms( $\sigma$ ,s1)}  $\cap$  {s2..min terms( $\sigma$ ,s2)}  $\neq \emptyset$ 
post  string( $\sigma'$ ,os1) = seq[s2..s2+n?]  $\cap$ 
      fill(#string( $\sigma$ ,s1)-n)
```

strcat (Z-notation)

strcat

```
 $\Delta$ State
s1? : Addr
s2? : Addr
os1!: Addr
```

```
terms( $\sigma$ ,s1?) $\neq \emptyset$   $\wedge$  terms( $\sigma$ ,s2?) $\neq \emptyset$   $\wedge$ 
  {s1! .. min terms( $\sigma$ , s2?)}  $\cap$ 
  {s2? .. min terms( $\sigma$ , s2?)} $\neq \emptyset$ 
string( $\sigma'$ ,os1!) = seq[s1!..min terms( $\sigma$ ,s1!)-1]  $\cap$ 
  string( $\sigma$ ,s2!)
terms ( $\sigma'$ ,s1!)  $\neq \emptyset$ 
```

strncpy (Z-notation)

strncpy

Δ State

s1? : Addr

s2? : Addr

n? : \mathbf{N}

os1! : Addr

$\text{terms}(\sigma, s1?) \neq \emptyset \wedge \text{terms}(\sigma, s2?) \neq \emptyset \wedge$
 $(s1 \dots \min \text{terms}(\sigma, s2)) \cap$
 $(s2 \dots \min \text{terms}(\sigma, s1)) \neq \emptyset$

$\text{string}(\sigma', os1!) = \text{seq}[s1 \dots \min \text{terms}(\sigma, s1) - 1] \cap$
 $\text{string}(\sigma, s2!)$

$\text{terms}(\sigma', s1) \neq \emptyset$

auxiliary functions

string

\exists State

s? : Addr

so! : $\mathbf{P}(\mathbf{N} \rightarrow \text{Char})$

$so! = \text{seq}[s? \dots \min \text{terms}(\sigma, s?)]$

fill: $\mathbf{N} \rightarrow \mathbf{P}(\mathbf{N} \rightarrow \text{Char})$

$\forall x: \mathbf{N} \bullet \text{dom fill } x = \{1..x\} \wedge \text{ran fill } x \subseteq \text{Terms}$