

Soft Eng 3M04  
Mid-Term II - makeup 2002  
Dr. Jacques Carette

Name: \_\_\_\_\_

Student No.: \_\_\_\_\_

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- This test contains 1 question on 3 double-sided sheets.
  - This test will be marked out of 20.
  - The mark from this test will replace the one from question 8 on midterm II.
  - Make sure that your name is on all sheets.
  - You may separate the pages.
  - You only need to hand in the last page, you may keep the others.
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1. Simulate the following MIS and MID. The simulation table is on the last page. [20]  
 $mod$  is the modulus function ( $\%$  in C and Java). It returns the (integer) remainder. Ex:  $13 \bmod 3 = 1$ ,  $2 \bmod 17 = 2$ ,  $-6 \bmod 4 = 2$  and  $256 \bmod 8 = 0$

### MIS

Used External Functions: NONE

Used External Data Types: NONE

Exported Constants: MaxSize:int

Exported Functions:

Name	Input Types	Output Types	Exceptions
init			
get	int	String	notinit, notpresent
put	int*String		notinit, full
remove	int	String	notinit, notpresent

State Variables:

tab : int\*String set

isinit : bool := false

Transition Functions:

init()

Transition:  $tab := \{\}$   
 $isinit := true$

String get(key:int)

Exception:  $\neg isinit \Rightarrow notinit$   
 $\neg \exists (k, s) \in tab. (k = key) \Rightarrow notpresent$

Output: s where  $(key, s) \in tab$

put(int key, String s)

Exception:  $\neg isinit \Rightarrow notinit$   
 $|tab| \geq MaxSize \Rightarrow full$

Transition:  $tab := \{(key, s)\} \cup (tab \setminus \{(key, t) \text{ where } (key, t) \in tab\})$

String remove(int key)

Exception:  $\neg isinit \Rightarrow notinit$   
 $\neg \exists (k, s) \in tab. (k = key) \Rightarrow notpresent$

Output: s where  $(key, s) \in tab$

Transition:  $tab := tab \setminus \{(key, t) \text{ where } (key, t) \in tab\}$

Use the value of MaxSize given in the MID.

### MID

Used External Functions: mod:int  $\rightarrow$  int

Constants: MaxSize := 3

p := 5

## Variables

```
String    a1[0..p-1]
int       a2[0..p-1]
int       a3[0..p-1]
bool      isinit := false
int       count
```

## Exported Functions

init()

```
local int i;
for (i :=0; i< p; i++) {
  (a1[i],a2[i],a3[i]) := ("", -2, 0);
}
isinit := true;
count := 0;
```

String get(key:int)

```
local h:int, off:int, i:int
if not(isinit) then ERROR(notinit) fi;
h := key mod p; i := h;
off := (key mod p-1) + 1;
while (a2[i]> -2) {
  if (a2[i]=h and a3[i]=key) then RETURN(a1[i]) fi;
  i := (i+off) mod p;
}
ERROR(notpresent);
```

put(int key, String s)

```
local h:int, off:int, i:int
if not(isinit) then ERROR(notinit) fi;
if count ≥ MaxSize then ERROR(full) fi;
h := key mod p; i := h;
off := (key mod p-1) + 1;
while (a2[i]> -1) {
  if (a2[i]=h and a3[i]=key) then
    a1[i] := s;
    RETURN;
  fi;
  i := (i+off) mod p;
}
(a1[i], a2[i], a3[i]) := (s,h,key);
count := count + 1;
```

```

String remove(int key)
  local h:int, off:int, i:int
  if not(isinit) then ERROR(notinit) fi;
  h := key mod p; i := h;
  off := (key mod p-1) + 1;
  while (a2[i] > -2) {
    if (a2[i]=h and a3[i]=key) then
      count := count - 1;
      a2[i] := -1;
      RETURN(a1[i]);
    fi;
    i := (i+off) mod p;
  }
  ERROR(notpresent);

```

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Give the value of all state variables, output and/or exception after each call in the following calling sequence for the MIS and MID on the previous page.

	MIS state	MID state	output or exceptions	
			MIS	MID
put(25,"a")				
init()				
put(25,"a")				
put(-25,"a")				
put(0,"b")				
put(0,"b")				
get(0)				
remove(0)				
get(0)				
put(280,"foo")				
remove(-25)				
put(280,"bar")				