Übungsblatt 5

Übungsgruppe Pentium

Stefan Schmauch, Nina Cami, Anton Lydike

Donnerstag 28.05.2020

Aufgabe 1) __ **/4+2+6p.**

Hier sind nur die relevanten Methoden ausgeschnitten, die "ausführbaren" Lösungen sind in den entsprechenden Dateien.

a)

```
; copy memory bytewise
; a0 = destination pointer
; a1 = source pointer
; a2 = length to copy
memcpy_bytewise:
    beq zero, a2, memcpy_ret
    lb  t1, 0(a1)
    sb  t1, 0(a0)
    add a0, a0, 1
    add a1, a1, 1
    add a2, a2, -1
    j memcpy_bytewise
memcpy_ret:
    ret
```

b)

```
; copy memory wordwise
; a0 = destination pointer
; a1 = source pointer
; a2 = length to copy
; all pointers must be word aligned, length must be multiple of 4
memcpy_wordwise:
    beq zero, a2, memcpy_ret
    lw  t1, 0(a1)
    sw  t1, 0(a0)
    add a0, a0, 4
    add a1, a1, 4
    add a2, a2, -4
    j memcpy_wordwise
memcpy_ret:
    ret
```

c)

```
; copy memory
; a0 = destination pointer
; a1 = source pointer
; a2 = length to copy
; make sure a0 and a1 have the same alignment
; after executing, a0 and a1 are inceremented by a2
memcpy:
        ; copy unaligned bytes at the front
                            ; t1: number of unaligned bytes upfront
        and t1, a0, 0x03    ; t1 = startptr % 4
        add t2, zero, -1    ; use t2 register to store immediate (-1) for next
            instruction, is overwritten later
        mul t1, t1, t2      ; t1 = -t1
        add t1, t1, 4       ; t1 = 4 + t1
        add t2, a2, 0       ; t2: original length
        add t3, ra, 0       ; t3: return address
        add a2, t1, 0
        jal memcpy_bytewise ; copy the first bytes

        ; copy aligned bytes
        sub a2, t2, t1      ; subtract copied bytes from length, save to a2
                            ; t1: number of unaligned bytes at the back
        and t1, a2, 0x03    ; t1 = length % 4
        sub a2, a2, t1      ; subtract unaligned bytes from length
        jal memcpy_wordwise ; copy aligned bytes wordwise

        add a2, zero, t1    ; a2 = remaining bytes to copy
        jal memcpy_bytewise ; copy remaining bytes bytewise

        ; restore return address
        add ra, zero, t3
        ret
```

Aufgabe 2) __ **/2+3+1p.**
Gesamtpunkte: __ **/18p.**