

## Problem Sheet #10

### Problem 10.1: *hangman character device in the linux kernel* (2+4+2+2 = 10 points)

The game hangman is a word guessing game. The player has to guess a word (or phrase) by guessing the characters that make up the word (or phrase). Your task is to implement a Linux kernel module implementing the hangman game. The interface to the hangman game is a character device. Lets simply look at an example execution of the game:

```
$ sudo insmod ./hangman.ko word='Hello World!' duration=60
$ cat /dev/hangman
_ _ _ _ _ _ _ _ ! (0 guesses, game timed out)
$ echo 'eaiouu' > /dev/hangman
$ cat /dev/hangman
_ e _ _ o _ o _ _ _ ! (6 guesses, time left: 60 seconds)
$ echo "lld" > /dev/hangman
$ cat /dev/hangman
_ e l l o _ o _ l d ! (9 guesses, time left: 20 seconds)
$ cat /dev/hangman
_ e l l o _ o _ l d ! (9 guesses, time left: 19 seconds)
$ echo "hwr" > /dev/hangman
$ cat /dev/hangman
H e l l o   W o r l d ! (solved with 12 guesses)
```

There are, of course, ways to play the game using brute-force:

```
$ sudo insmod ./hangman.ko word='Hacking Linux!'
$ echo "etaoinshrdlcumwfgypbvkjxqz" > /dev/hangman
$ cat /dev/hangman
H a c k i n g   L i n u x ! (solved with 24 guesses)
```

The `word` parameter of the kernel module defines the word or phrase to guess. The `duration` module parameter defines the duration (in seconds) of the game; the game resets itself once the game duration has expired.

Characters are guessed by writing to the character device file `/dev/hangman`. The content of the file shows the current status of the game.

Only alphabetical characters are guessed, punctuation characters or numbers appearing in a word or phrase are not guessed (i.e., they are ignored by the character device). Note that characters are always guessed in lowercase and that a guessed character matches both lowercase and uppercase characters in the word or phrase.

The assignment can be broken down into the following steps:

- Implement a kernel module that creates a character device `/dev/hangman`.
- Implement a data structure that keeps track of the characters already guessed and the count of guesses made. When characters are written to the device `/dev/hangman`, mark the characters received from the user as guessed and subsequently generate file content that indicates the status of the game play. Provide the file content when the device `/dev/hangman` is read.
- Implement module parameters that enable to define the word to be guessed and the duration of the game while loading your kernel module.

- d) Add the automatic reset mechanism by setting a timeout for the game when the game started, i.e., when the first guess is made. Upon subsequent guesses, check whether the game has timed out or not. If the game has timed out, reset it to its initial state.

Make sure your code is robust. It should do something sensible if, for example, the word to guess is a zero-length string or does not contain any alphabetic characters. Also try to make no assumptions on the size of the word or phrase.