CS Basics - Exercises
Concurrency in C

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1 `exec()` and I/O Redirection

Write a program which replaces itself with another program of your choice. Redirect `stdin` and `stdout` to two files, which have to be specified as arguments when starting the program.

2 Threads

Write a program which starts a configurable number of threads (e.g. passed as argument when starting the program). All threads increment a single, global variable by one for a given number of times (equal for every thread). Choose that number such that the program runs for a few seconds on your machine. Join the threads and print the value before exiting.

Do you obtain correct results? Always, with any number of threads? If no, why not?

3 Linking against GNU adns

Install the GNU adns library (including development headers).

Compile, link and run the following program:

```
#include <stdio.h>
#include <adns.h>
#include <arpa/inet.h>

int
main(int argc, char **argv)
{
  adns_state ads;
  adns_answer *answer;
  int ret;
```

```
    char buf[128];

    ret = adns_init (&ads, adns_if_none, NULL);
    if (0 != ret)
      return ret;
    ret = adns_synchronous (ads,
                            argv[1],
                            adns_r_a,
                            adns_qf_want_allaf,
                            &answer);
    if (0 != ret)
      return ret;
    if (adns_s_ok != answer->status)
      return 1;
    // TBC
    adns_finish (ads);
    return 0;
}
```

- What happens if you give a valid domain name as the argument?

- What happens if you give a non-existing domain name as the argument?

- What happens if you give no arguments?

Modify the code to handle error cases nicely by printing an appropriate error message.

3.1 IPv4 name resolution

At the "TBC" comment, the `answer` variable contains an IPv4 address of the domain that was given on the command line. You will need to study the `/usr/include/adns.h` header to understand what `answer` contains. Note that the IPv4 address is inside of adns_answer as a `struct in_addr` (see `man 7 ip` for details).

Modify the code to print out the IP address in the usual dotted decimal format. Use the `inet_ntop()` function to convert the `struct in_addr` to a string. You should provide a stack-allocated array of at least INET_ADDRSTRLEN bytes for the `dst` argument.

3.2 IPv6 support

Add a command-line option `-6` to optionally resolve a DNS name to an IPv6 (AAAA) record.

Explain the reasoning behind the design of the `adns_answer` type.