1. **DNS – Resource Records**

   Together with two friends, you want to play the online game Minecraft. To coordinate the provider for the game server, you contact them via email. Their email addresses belong to the domains `google.com` and `heise.de`.

   (a) Which servers are responsible for accepting emails on behalf of the users? How did you discover the servers?

   You decided to use a server within the domain `stung.withalan.net`. The service you will use is called `minecraft`, which runs over TCP.

   (b) What is the name of the game server? Which record type did you request?
   Hint: Take a look at RFC 2782.

   (c) To which port do you need to connect?

   (d) What is the conceptual difference between the resource records requested in (a) and (b).

2. **DNS – Caching**

   According to RFC 1035, DNS caching of resource records (RR) is influenced by two parameters, the `MINIMUM` field within the SOA record for a zone, and TTL value per resource record: *"Whenever a RR is sent in a response to a query, the TTL field is set to the maximum of the* TTL *field from the RR and the MINIMUM field in the appropriate SOA."*

   In the following we want to explore the actual deployment state of DNS records and discuss implications of caching.

   (a) Write a small script (e.g., using Perl, Python) that requests the `SOA` and `A` of the domains within the file `top500-domains.txt`.

   (b) Plot the distribution of `MINIMUM` values. What are typical values? Why do zone administrators configure different values?

   (c) Design a concept which checks if DNS servers follow RFC 1035 with respect to the TTL field.
   Hint: The TTL value is a "count down". You can observe this by running your script multiple times.

   (d) Is the TTL for `bleacherreport.com` set correctly?

   You want change the name-to-address mapping of a web server, i.e., replace the values within `A` and `AAAA` records.

   (e) What do you need to consider to implement a smooth transition from the old to new IP addresses?

3. **WWW and HTTP – Browsing**

   You do not have a web browser but you nevertheless want to access a web page.

   (a) Run the `telnet` program: `telnet www.heise.de 80`

   (b) Which command do you need to submit to receive the index page?

   (c) What do you see in the `telnet` program after you executed the command?

4. **WWW and HTTP – Tracking**

   You want to offer a service that tracks a user over multiple web servers to provide customer-specific advertisement. For example, a user that looks for a specific item on `http://www.shop.com` should get an embedded advertisement for the same type of items when he visits another website, `http://www.news.com`.

   (a) Which mechanism is usually employed to maintain state within the browser by the web server?

   (b) Design a concept to implement the desired tracking service.

   (c) Sketch the communication flow between the different components.