1. Briefly explain (2 – 3 lines) the following protocols:
   HTTP
   HTML
   SMTP
   RFC822
   POP3

2. One reasonable way of grouping the above protocols into two sets is {HTTP, HTML} and {SMTP, RFC822, POP3}. Another reasonable grouping is as {RFC822, HTML} and {HTTP, SMTP, POP3}. Explain why both groupings are reasonable.

   HTTP and HTML relate to world wide web. SMTP, RFC822 and POP3 are related to Email.

   HTTP, SMTP and POP3 are client-server protocols
   RFC822 and HTML are formats for content

3. When you direct your browser to http://groklaw.net a DNS query is sent from your computer. A DNS response is received which includes the IP address corresponding to the name groklaw.net. Explain the series of steps involved in this process.

   1. Browser calls gethostbyname(groklaw.net)
   2. The call is handled by a stub resolver running on the local machine
   3. Stub resolver inspects its cache to see if it has the A type record for groklaw.net. If so gethostbyname() returns with the desired IP address
   (Say Not found in cache of stub resolver)
   4. Stub resolver sends a DNS query to a local DNS (LDNS) server. The IP address of the LDNS can be found in a file /etc/resolv.conf
   5. LDNS inspects its cache (assume not found in cache)
   6. LDNS sends a query for the A type record for groklaw.net to a root DNS server
   7. Root DNS server returns a redirection, providing the IP address of a DNS server for the generic top level domain (gTLD) .net
   8. LDNS sends a query to the gTLD DNS server
   9. The gTLD .net returns the IP address of a server authoritative for groklaw.net (If you actually tried using dig to do this you would find that the name servers authoritative for groklaw.net are ns.unc.edu (with IP address 152.2.21) and ns2.unc.edu (IP address 152.2.253.100)
   10. LDNS sends a query to one of the authoritative name servers
   11. the authoritative name server will return the IP address (in this case 152.46.7.105)

4. Explain the difference between recursive and iterative DNS queries. Illustrate using the query response process for resolving groklaw.net.

   Recursive query: When a recursive query is received the responser is expected to answer the question and not redirect the querier to some one else. If the LDNS had made a recursive query to the root DNS server, the root DNS server will ask the .net server. The .net server will then ask the authoritative name server for groklaw.net. The answer is sent by the .net server to the root server. The root server will then send the answer back to the LDNS. The LDNS will simply wait while all this takes place.

   In practice stub resolvers make recursive queries to LDNSs. LDNSs however make a series of iterative queries.