

EXAMINATIONS — 2011
END-YEAR

NWEN 243
NETWORK APPLICATIONS

Time allowed: THREE HOURS

Instructions: The examination contains 6 questions.

Each question is worth 20 marks.

The exam consists of 120 marks in total.

Paper foreign to English language dictionaries are allowed.

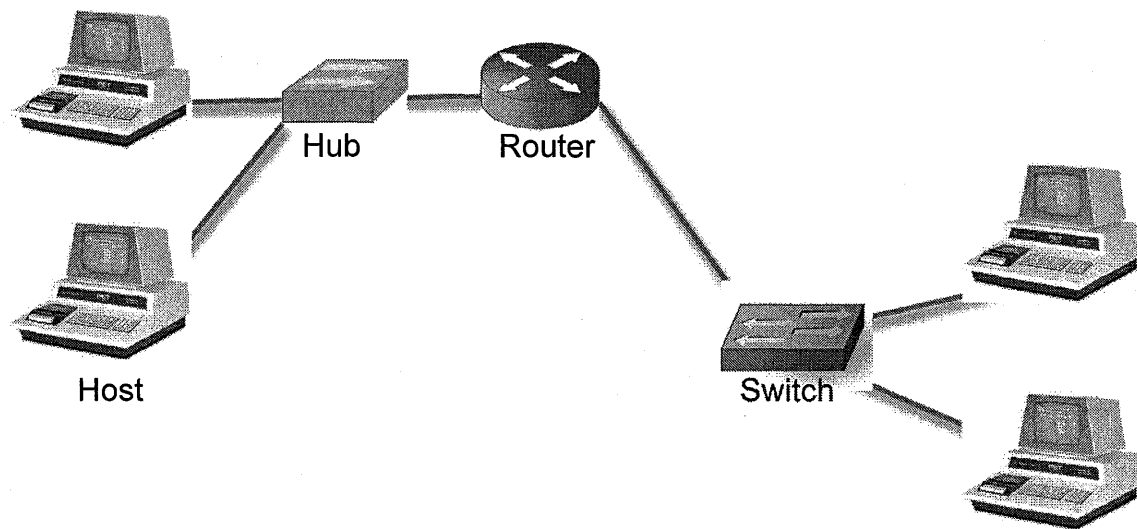
Non-programmable calculators are allowed

Electronic dictionaries and programmable calculators are not allowed.

Question 1 Networking

[20 marks]

- (a) [2 Marks] What is the Internet?
- (b) [4 Marks] What is a protocol in the context of networking? Include in your answer an example of a simple protocol.
- (c) [4 Marks] Explain the steps taken to send a datagram from an application on one host to another.
- (d) [4 Marks] How do layers coordinate their actions between separate hosts? Include in your answer an example of layer coordination.
- (e) [6 Marks] Consider the following small network.



Show which layers of the network stack are implemented in each of the labelled devices.

Question 2 TCP/IP

[20 marks]

- (a) You have a $\frac{1}{2}$ Class C (/25) IPv4 address, 198.124.182.128, you have been asked to divide this into 8 equal subnets.
- [2 Marks] How many IP addresses will be in each subnet?
 - [4 Marks] For the 4th subnet state the network address.
 - [2 Marks] For the 4th subnet state the broadcast address.
 - [2 Marks] What is the subnet mask?
- (b) [2 Marks] Why is TCP considered an hourglass protocol?
- (c) [2 Marks] What is the difference between a name and a location?
- (d) [6 Marks] Outline the Go-Back-N protocol.

Question 3 Security

[20 marks]

- (a) [2 Marks] What does it mean for a cryptographic system to be secure?
- (b) [2 Marks] What is Kerckhoff's Principle?
- (c) [2 Marks] Why might we want a polyalphabetic cypher?
- (d) [2 Marks] What are homophones and why were they adopted?
- (e) [4 Marks] What was the essential problem that public key cryptography was developed to solve. Hint: the answer is NOT secrecy.
- (f) [8 Marks] Outline public key encryption.

Question 4 Web Services

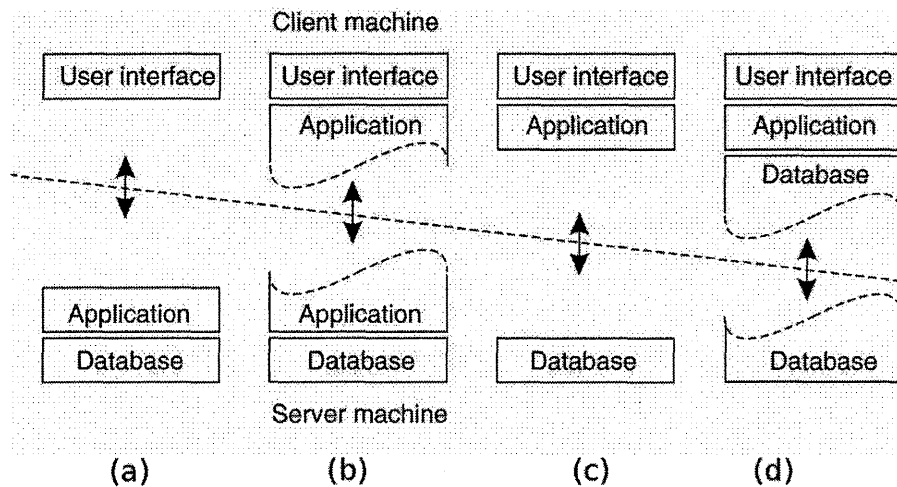
[20 marks]

- (a) You connect to a Web server to download a Web page that contains a form to be completed and uploaded back to the Web server.
- i. [3 marks] What commands does your browser issue to the Web server to download the Web page and to upload the completed form in the page?
 - ii. [3 marks] There is a transparent proxy cache in the middle of your network connection. Explain why it can cache the page before the form is filled out but not afterwards.
- (b) [2 Marks] Distinguish a *cluster computing system* from a *GRID computing system*.
- (c) [3 Marks] What is the role of WSDL?
- (d) [3 Marks] List the THREE operations that *memcached* supports?
- (e) [6 marks] Three kinds of XML stanza are defined in RFC3920 for the 'jabber:client' and 'jabber:server' namespaces. Name the three kinds and give a brief description of what each one is used for.

Question 5 Caching, Replication and Architecture

[20 marks]

- (a) [4 marks] Identify at least TWO key differences between caching and replication.
- (b) [6 Marks] Outline the master-slave protocol for writing data to a set of replicas. Use a diagram to help with your explanation.
- (c) [10 Marks] Give an example of possible implementations for each of the following two-tiered client-server architectures. For each example, specify what role is being played by each component and the nature of the communication between the client and the server.



Question 6 Distributed Systems

[20 marks]

The Domain Name System (DNS) is a large, successful distributed system. Its primary service is to map keys (such as host names) to values.

- (a) [2 Marks] Define the term *distributed system*.
- (b) [4 marks] What are the major components of the DNS and how do they interact?
- (c) [4 Marks] Using a diagram, describe what happens during an *iterative* DNS query.
- (d) [3 Marks] Why is the DNS divided into zones?
- (e) [7 marks] The eight dimensions of transparency in distributed systems are shown in the following table:

Transparency	Description
Access	Hide differences in data representation and how a resource is accessed
Location	Hide where a resource is located
Migration	Hide that a resource may move to another location
Relocation	Hide that a resource may be moved to another location while in use
Replication	Hide that a resource is replicated
Concurrency	Hide that a resource may be shared by several competitive users
Failure	Hide the failure and recovery of a resource

Based on your knowledge of the DNS, give examples of how the DNS implements two of the eight dimensions.
