Mid-Semester Test
(EC-2 Regular)

Course No.   : ISZC446
Course Title   : Data Storage Technologies and Networks
Nature of Exam   : Closed Book
Weightage   : 35%
Duration   : 2 Hours
Date of Exam   : 00/02/2015   (FN)

No. of Pages	= 1
No. of Questions	= 11

Note:
1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

Q.1.   Compare and contrast the 3 different disk interfaces   [3 Marks]
A1. The three interfaces are SATA, SAS, FC [1 Mark]. Comparison table as below [2 Marks]

Interface factor	SATA	SAS	FC
Use	Desktop	Enterprise	Enterprise
Speed	1.5Gbps / 3 Gbps	3.0 Gbps	2 Gbps / 4 Gbps
Distance	1m internal cable	10 m	10 Km
Cabling	Copper	Copper	Copper/Optical

Q.2.   What are the benefits of a NAS solution? Explain in brief.   [3 Marks]
A2. NAS Appliance installs easily. NAS Costs are much cheaper. NAS Scales seamlessly. NAS Speed is improving. NAS is completely transparent to OS on client nodes. [Each of the above points on an average can carry 0.5 marks. If all points have been mentioned, award 3 marks]

Q.3.   Explain in detail what is server I/O consolidation and its benefits   [3 Marks]
A3. Server I/O Consolidation is consolidation of various traffic types onto a single interface and a single cable when multiple parallel networks are being used like IP Applications, SAN over a FC network, HPC networks etc. [1 mark]. The main benefits of this consolidation are: a) Able to use multi core CPUs effectively b) Server virtualization enablement c) High demand for I/O bandwidth d) Reductions in cable, power and cooling expenses and thereby reduced OpEx expenses e) Limited number of interfaces for Blade servers f) Consolidated input into unified fabric [2 marks]

Q.4.   Explain in brief iSCSI protocol and how iSCSI PDU is typically encapsulated in TCP/IP
      stack   [3 Marks]
A4. iSCSI (internet Small Computer System Interconnect) is a SCSI transport protocol for mapping of block oriented storage data over TCP / IP networks. This enables universal access to storage devices and SANs over standard TCP networks on Ethernet, ATM WANs, SONET WANs, Wireless, etc. [1 mark].
The data encapsulation into network packets will be as follows: [2 marks]

Ethernet Header	IP	TCP	iSCSI	SCSI Cmds	Optional DATA	FCS (CRC)

iSCSI Protocol Data Unit (PDU): Provides ordering and control information. Contains iSCSI control info, with optional SCSI Commands &/or Data

Provides Reliable data transport and delivery (TCP Windows, ACKs, ordering, etc.) Also demux within node (port numbers)

Provides IP "routing" capability so that packet can find its way through the network

Provides physical network capability (Cat 5, MAC, etc.)

Q.5. Explain in detail with a diagram what is an INODE in a file system.   [3 Marks]
A5: When a file system is created, data structures that contain information about files are created. Each file has an inode and is identified by an inode number (often referred to as an "i-number" or "inode") in the file system where it resides.   [1 Mark]
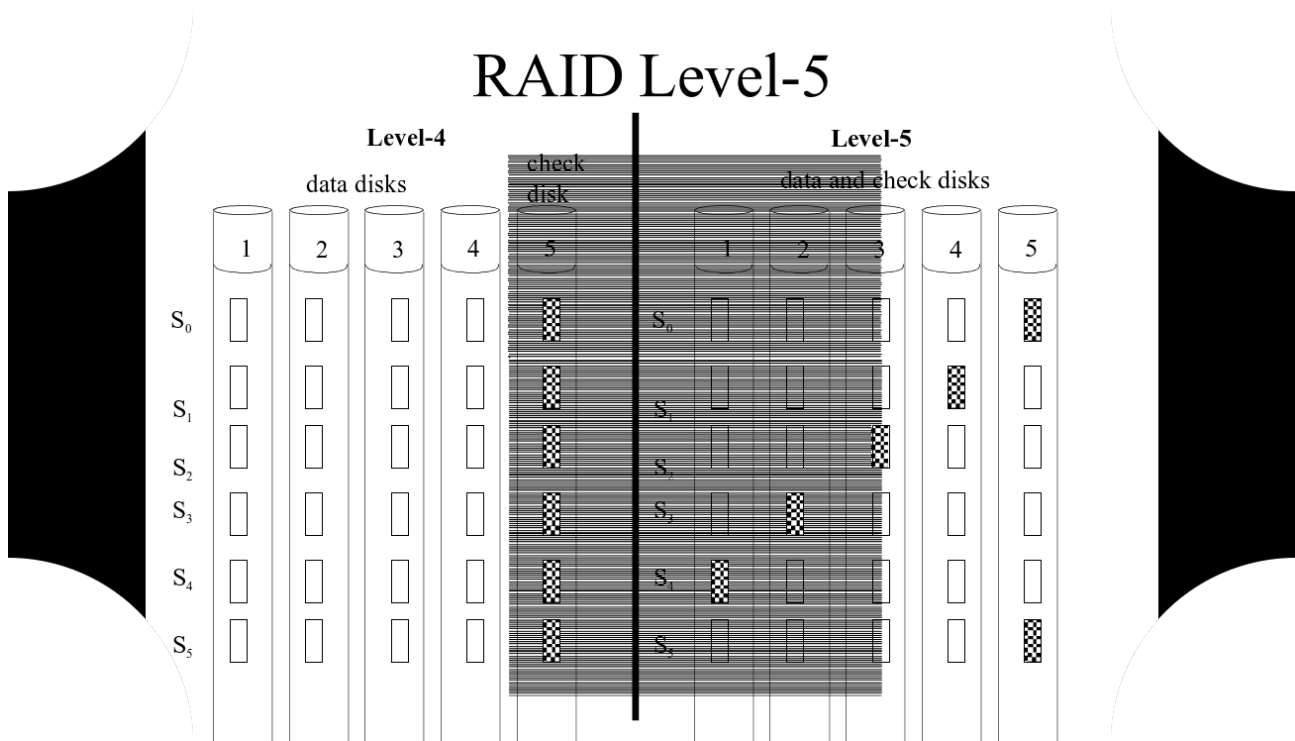
[Something like a following representation diagram can be awarded the remaining 2 marks]
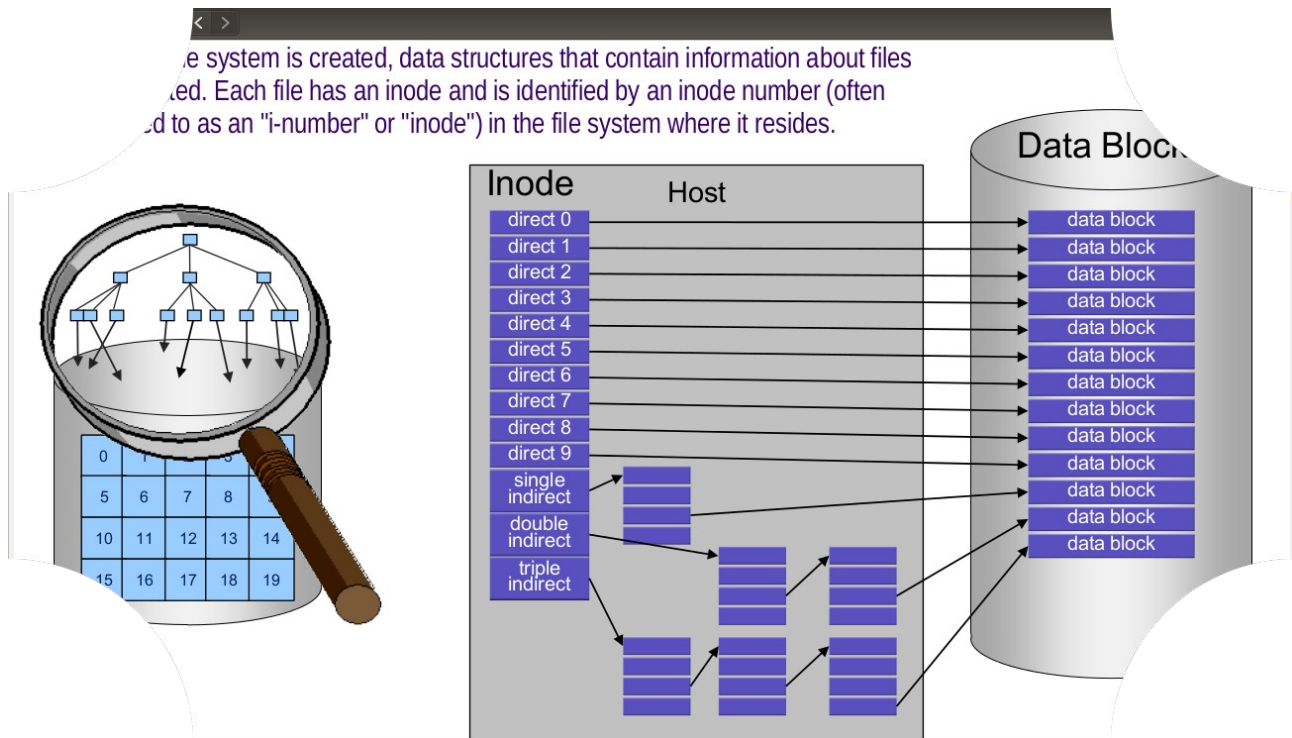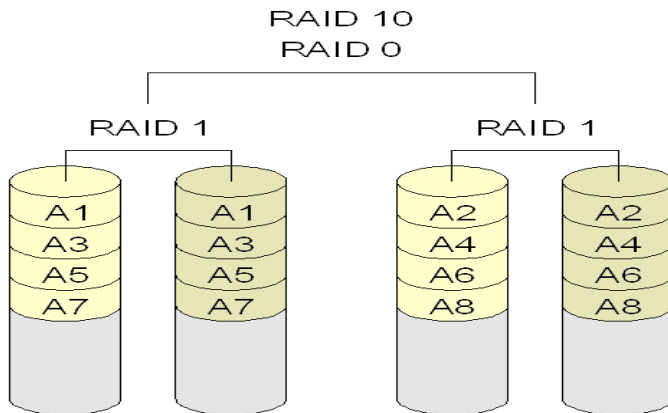

Q.6. Explain in detail with a diagram how RAID-5 and RAID-10 works.   [3 Marks]

Representational diagram with details for RAID – 5 [1.5 marks]

RAID Level-5

Representational diagram with details for RAID – 10 [1.5 marks]

Q.7. What are the main enhancements made in SMB 3.0 version that was made to make it useable in enterprise environment?   [4 Marks]

A7:   [On an average award 1 mark for each of the subset of enhancements that has been mentioned. If all these enhancements have been mentioned, award the total of 4 marks]

Availability
    SMB Transparent Failover
    SMB Witness
    SMB Multichannel
Performance
    SMB Scale-Out
    SMB Direct (RDMA)

SMB Multichannel
Directory Leasing
BranchCacheTM V2

Security
SMB Encryption – AES-CCM
Signing - AES-CMAC
Management
PowerShell over WS-Man
SMI-S File
Backup
VSS for SMB File Shares

Q.8.   Explain in detail the main features/enhancements of NFS V4   [3 Marks]
A8: Strong security framework, ACLs for Windows compatibility, Integration of security with kerberos, Uniform and infinite namespace, Stateful clients introduced, Introduced Sessions to know if the other side received data [On an average, award 0.5 marks for each of these. If all points have been given, award 3 marks fully]

Q.9.   Explain in detail the justification for NFS v4.1 (Both functional and business benefits of
        going in for NFS v4.1)   [3 Marks]

A9: [If any of the three below mentioned points have been mentioned, award 3 marks fully]

	Functional	Business Benefit
Security	ACLs for authorization Kerberos for authentication	Compliance, improved access, storage efficiency, WAN use
High availability	Client and server lease management with fail over	High Availability, Operations simplicity, cost containment
Single namespace	Pseudo directory system	Reduction in administration & management
Performance	Multiple read, write, delete operations per RPC call	Better network utilization for all NFS clients
	Delegate locks, read and write procedures to clients	Leverage NFS client hardware for better I/O
	Parallelised I/O	

Q.10. Explain in brief the different iSCSI Message Types (PDUs) between Initiator to target and from target back to Initiator   [3 Marks]

A10:

[Award 1.5 marks each for Initiator to target and Target to Initiator respectively. The different commands are mentioned below]
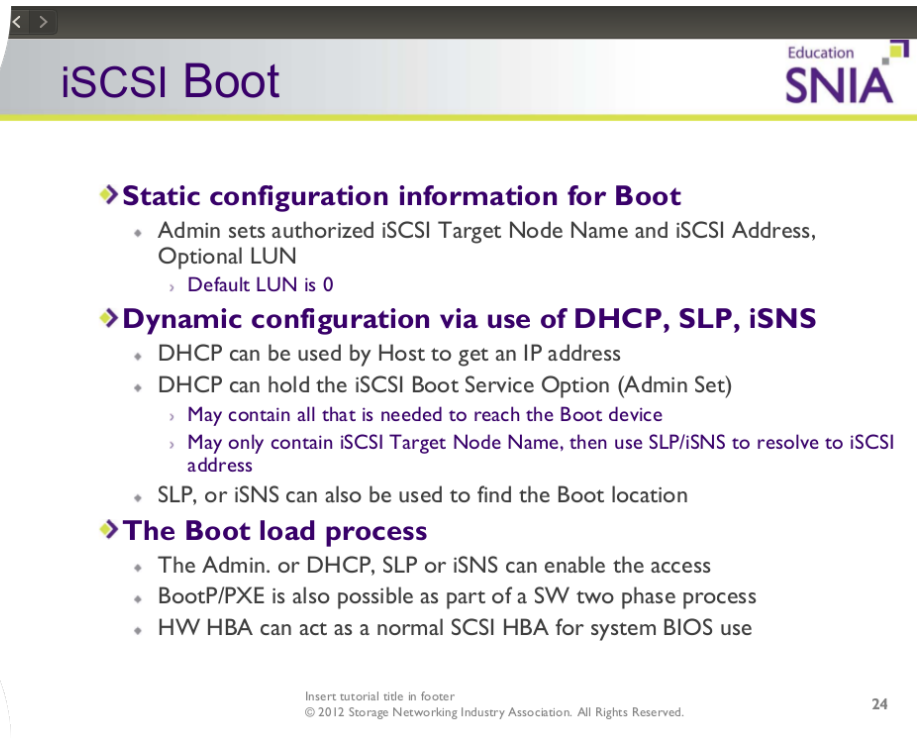

Q.11.

a) What is redirection in iSCSI protocol? Where is it used?

b) How can iSCSI protocol be used for booting?   [2 + 2 Marks]

A11: a) After initiator tries to a login to a target, it can be redirected by the specified target either temporarily or permanently. [1 mark] Redirection is used for corrections between discovery db updates, for load balancing, automatic disablement of hardware due to HW problems [1mark]

b) [If the below mentioned details are explained, award 2 marks]

iSCSI Boot

◆ Static configuration information for Boot
- ◆ Admin sets authorized iSCSI Target Node Name and iSCSI Address, Optional LUN
  - › Default LUN is 0

◆ Dynamic configuration via use of DHCP, SLP, iSNS
- ◆ DHCP can be used by Host to get an IP address
- ◆ DHCP can hold the iSCSI Boot Service Option (Admin Set)
  - › May contain all that is needed to reach the Boot device
  - › May only contain iSCSI Target Node Name, then use SLP/iSNS to resolve to iSCSI address
- ◆ SLP, or iSNS can also be used to find the Boot location

◆ The Boot load process
- ◆ The Admin. or DHCP, SLP or iSNS can enable the access
- ◆ BootP/PXE is also possible as part of a SW two phase process
- ◆ HW HBA can act as a normal SCSI HBA for system BIOS use