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by Y4Z YASIRU PRABODHA

Understanding the inside structures of a computer

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Thank you, Mr. Priyanga, for raising high standards and curiosity for your students.

Sincerely,

Yasiru Prabodha

Executive Summary

This Report addresses the basic concepts of computer architecture and how they are implemented in actual practice to design IT infrastructure for organizational growth. Comprising two sections, the analysis juxtaposes theoretical thoughts with actual implementation strategies to implement according to Concept Innovations' new Kandy office needs.

Part 1: Fundamentals of Computer Architecture Concepts

The first segment offers fundamental knowledge about computer systems. It discusses converting decimal numbers, such as 6518 and 73578, into hexadecimal form (1976_{16} and $11F6A_{16}$, respectively). This illustrates the significant role that base conversion plays in computer systems. Moreover, utilizing 8-bit 2's complement representation of negatives (e.g., -84 is 10101100 and -13 is 11110011) shows that if you are dealing with binary, you can handle signed integers just fine. For binary arithmetic operations such as $2 - 11 = 00001100$, which is 2 two's complement binary and 1's complement binary representation respectively, -14 such as -42 and -13 and -43 respectively; 0 2's complement, binary octets (0, 2, 4, 8, 16).

The laws of Boolean algebra are applied to simplify complex expressions. For instance, the expression (A+B) (A+C+B) can be reduced to $A + B$ using the distributive, Idempotent and Redundancy laws. Similarly, the expression A'BC + AB' + BC' simplifies to $B(C' + A') + AB'$ through the consensus theorem. These simplifications show how Boolean principles can minimize digital circuit designs. A case study of a security system further exemplifies these concepts. In the analysis of a 4-sensor access control system, a truth table and the Boolean expression are derived. Simplifying using a Boolean algebra leads to the expression $AB(C + D) + CD(A + B)$, which can then be transformed into a circuit using AND and OR gates. This example illustrates how theoretical concepts are translated into practical hardware solutions.

Part 2: IT Infrastructure for Concept Innovations

The second section tailor's computer architecture principles to Concept Innovations' operational needs. Hardware recommendations are tuned to individuals' needs for their roles: software engineers and UX/UI designers can afford high-end PCs with Intel i9 CPUs, NVIDIA RTX GPUs to ensure they can multitask seamlessly on vector renders, while a lightweight laptop with Intel i5 processors will do for accounting teams. Xeon-based servers, often configured with RAID, help database administrators strike a balance between speed and data redundancy.

Like Adobe Creative Suite and Figma, project managers use tasks coordination tools such as Jira and Trello. System software, including Windows 11 for user-friendly interfaces and Linux for servers, ensures compatibility and security.

The proposed system design integrates peripherals such as dual monitors for developers, ergonomic keyboards for prolonged use, and biometric scanners for physical security. Network-attached storage (NAS) boxes and centralized servers enable sharing of data, while CCTV systems provide improved surveillance. A critical evaluation recognizes the design advantages of scalability and role-based optimization but also the disadvantages of upfront costs and compatibility. Suggestions are made to utilize cloud computing for remote access, predictive maintenance through IoT sensors, and investigate AI-based analytics for future growth. Lastly, the OS strategy has a mix of Windows for end-user convenience and Linux for server reliability, offering a balance between usability, security, and affordability.

Conclusion

By merging theoretical computer architecture concepts with practical IT solutions, this report provides a roadmap for Concept Innovations' Kandy branch. Part one focuses on the technical precision of digital systems while part two provides a customized infrastructure framework with a focus on performance, security, and scalability. Both allowing for the organization's growth expansion through technological and operational efficiencies.

Part 01 Task

1.1.A.I) 6518

To solve this,

First, you need to divide the decimal number by 16 and write the remainder until you get 0.

If a reminder is bigger than 9 use $A - F$ letters to represent it.

$(10 = A, 11 = B, 12 = C, 13 = D, 14 = E, 15 = F)$

Then write down the remainder from bottom to top.

$$\begin{array}{ccccl}
 & & & & \text{remainder} \\
6518 \div 16 & = & 407 & \longrightarrow & 6 \\
407 \div 16 & = & 25 & \longrightarrow & 7 \\
25 \div 16 & = & 1 & \longrightarrow & 9 \\
1 \div 16 & = & 0 & \longrightarrow & 1
\end{array}$$

Answer: 1976_{16}

1.1.A.II) 73578

$$\begin{array}{ccccll}
 & & & & \text{remainder} \\
73578 \div 16 & = & 4598 & \longrightarrow & 10 & (10 = \mathbf{A}) \\
4598 \div 16 & = & 287 & \longrightarrow & 6 \\
287 \div 16 & = & 17 & \longrightarrow & 15 & (15 = \mathbf{F}) \\
17 \div 16 & = & 1 & \longrightarrow & 1 \\
1 \div 16 & = & 0 & \longrightarrow & 1
\end{array}$$

Answer: $\mathbf{11F6A}_{16}$

1.1.B.I) -84

To convert into binary form,

   First, divide the decimal value by 16 until you reach 0 (ignore the minus sign for now).

   Write down the remainder each time you divide.

   Then write the remainders from bottom to top.

remainder

$84 \div 2 = 42 \longrightarrow 0$

$42 \div 2 = 21 \longrightarrow 0$

$21 \div 2 = 10 \longrightarrow 1$

$10 \div 2 = 5 \longrightarrow 0$

$5 \div 2 = 2 \longrightarrow 1$

$2 \div 2 = 1 \longrightarrow 0$

$1 \div 2 = 0 \longrightarrow 1$

1010100_2

To Convert into 8bit form,

   If the bit value doesn't have 8bits add an extra 0 to front.

$1010100_2 \longrightarrow$ **01010100_2**

To Convert into 1's Complement,

   Invert every 1 into 0 and 0 into 1.

0 1 0 1 0 1 0 0

↓↓↓↓↓↓↓↓

1 0 1 0 1 0 1 1

10101011_2

To Convert into 2's Complement,

   Add an extra 1 bit to the last bit.

```
  10101011
+        1
─────────
  10101100
─────────
```

Answer: 10101100_2

- The most significant bit (the leftmost bit) is set to 1, which indicates that the number is negative.

1.1.B.II) -13

Convert into binary form,

remainder

$$13 \div 2 = 6 \longrightarrow 1$$
$$6 \div 2 = 3 \longrightarrow 0$$
$$3 \div 2 = 1 \longrightarrow 1$$
$$1 \div 2 = 0 \longrightarrow 1$$

1101_2

Convert into 8bit form,

$1101_2 \longrightarrow$ **00001101_2**

Convert into 1's Complement,

0 0 0 0 1 1 0 1
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
1 1 1 1 0 0 1 0

11110010_2

Convert into 2's Complement,

```
  11110010
 +      1
 ─────────
  11110011
 ─────────
```

Answer: **11110011_2**

- The most significant bit is 1 which means the number is negative.

1.2.A) To solve this,

First, convert -15 and 27 into 2's complement.

Then add the values together.

-15 Conver to 2's complement

Convert to bit form,

remainder

$$15 \div 2 = 7 \longrightarrow 1$$
$$7 \div 2 = 3 \longrightarrow 1$$
$$3 \div 2 = 1 \longrightarrow 1$$
$$1 \div 2 = 0 \longrightarrow 1$$

1111_2

Convert into 8bit,

$1111_2 \longrightarrow 1111_2$

Convert into 1's Complement,

0 0 0 0 1 1 1 1

1 1 1 1 0 0 0 0

11110000_2

Convert into 2's Complement,

11110000

$\underline{\quad +1 \quad}$

$\underline{11110001}$

$\mathbf{-15 = 11110001_2}$

27 Convert to 2's complement

Convert to binary,

remainder

$27 \div 2 = 13 \longrightarrow 1$

$13 \div 2 = \ 6 \longrightarrow 1$

$\ 6 \div 2 = \ 3 \longrightarrow 0$

$\ 3 \div 2 = \ 1 \longrightarrow 1$

$\ 1 \div 2 = \ 0 \longrightarrow 1$

11011_2

Convert into 8bit,

$11011_2 \longrightarrow 00011011_2$

- For positive numbers, the complements of the 1's and 2's are the same as those of the binary representation.

$\mathbf{27 = 00011011_2}$

Sum of -15 and 27

$\quad 1111\ 0001 \longleftarrow (-15)$

$\underline{+\ 0001\ 1011 \longleftarrow \ \ (27)}$

$\underline{\mathbf{1\ 0000\ 1100}}$

- Since this binary result exceeds 8 bits, please disregard any overflow that goes beyond that limit.

Answer: 00001100_2

1.2.B)

-42 convert to 2's complement,

Convert to binary,

remainder

$42 \div 2 = 21 \longrightarrow 0$
$21 \div 2 = 10 \longrightarrow 1$
$10 \div 2 = 5 \longrightarrow 0$
$5 \div 2 = 2 \longrightarrow 1$
$2 \div 2 = 1 \longrightarrow 0$
$1 \div 2 = 0 \longrightarrow 1$

101010_2

Convert to 8bit form,

$101010 \longrightarrow 00101010$

Convert into 1's Complement,

0 0 1 0 1 0 1 0
↓↓↓↓↓↓↓↓
1 1 0 1 0 1 0 1

11010101_2

Convert into 2's Complement,

11010101

$\underline{+1}$

$\underline{11010110}$

$-42 = 11010110_2$

− 13 convert to 2's complement,

Convert to binary,

remainder

$13 \div 2 = 6 \longrightarrow 1$

$6 \div 2 = 3 \longrightarrow 0$

$3 \div 2 = 1 \longrightarrow 1$

$1 \div 2 = 0 \longrightarrow 1$

1101_2

Convert into 8bit,

$1101_2 \longrightarrow 00001101_2$

Convert into 1's Complement,

0 0 0 0 1 1 0 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 1 1 1 0 0 1 0

11110010_2

Convert into 2's Complement,

11110010

      +1
_____

11110011
_____

−13 = 11110011$_2$

Sum of −42 and −13

  1101 0110 ⟵ (−42)

+ 1111 0011 ⟵ (−13)
_____

1 1100 1001
_____

- Since this binary result exceeds 8 bits, please disregard any overflow that goes beyond that limit.

Answer: 11001001_2

1.3.A) $(A + B)(A + C + B)$

Apply Distributive Law $[\,(A + B)$ over $(A + C + B)]$

- $(A + B)A + (A + B)C + (A + B)B$
- $A.A + B.A + A.C + B.C + A.B + B.B$

Apply Idempotent Law $[\,A.A = A\,,\ B.B = B\,]$

- $A + B.A + A.C + B.C + A.B + B$

Apply Redundancy Law $[\,A + B.A = A\,,\ A.B + B = B\,]$

- $A + A.C + B.C + B$

Apply Redundancy Law $[\,A + A.C = A\,,\ B.C + B = B\,]$

- $A + B$

Answer: $\boldsymbol{A + B}$

1.3.B) $A'BC + AB' + BC'$

Apply Commutative Law $[\,AB'$ switch position with $BC'\,]$

- $A'BC + BC' + AB'$

Apply Distributive Law $[\,A'BC + BC' = B(A'C + C')\,]$

- $B(A'C + C') + AB'$

Apply Commutative Law $[\,A'C + C' = \ C' + A'C\,]$

- $B(C' + A'C) + AB'$

Apply Commutative Law [$AC' = CA'$]

- $B(C' + CA') + AB'$

Apply Redundancy Law [$C' + CA' = C' + A'$]

- $B(C' + A') + AB'$

Answer: $\mathbf{B(C' + A') + AB'}$

1.3.C) $(A + B)(A' + B')(C + D)$

Apply Distributive Law [$(A + B)$ over $(A' + B')$]

- $(\ (A + B)A' + (A + B)B'\ )(C + D)$
- $(AA' + AB' + BA' + BB')(C + D)$

Apply Inverse/Complement Law [$A.A' = 0$, $B.B' = 0$]

- $(0 + AB' + BA' + 0)(C + D)$
- $(AB' + BA')(C + D)$

Answer: $(\mathbf{AB' + BA'})(\mathbf{C + D})$

1.4.A)

$S = (A.B.C) + (A.B.D)$

$M\ = (A.C.D.) + (B.C.D)$

$X = (A.B.C) + (A.B.D) + (A.C.D) + (B.C.D)$

A	B	C	D	A.B	A.B.C	A.B.D	A.C.D	B.C.D	S	M	X
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0
0	1	0	1	0	0	0	0	0	0	0	0
0	1	1	0	0	0	0	0	0	0	0	0
0	1	1	1	0	0	0	0	1	0	1	1
1	0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0	0	0	0	0
1	0	1	1	0	0	0	1	0	0	1	1
1	1	0	0	1	0	0	0	0	0	0	0
1	1	0	1	1	0	1	0	0	1	0	1
1	1	1	0	1	1	0	0	0	1	0	1
1	1	1	1	1	1	1	1	1	1	1	1

1.4.B)

To solve this,

First, write the problem using if-else statements (like pseudocode).

Then, use an AND gate for 'and' and an OR gate for 'else'. (Kwon, 2025)

- Your statement else doesn't have any action don't add a gate for it.

Write statement

IF A AND B AND C = TRUE

 # Trigger Alarm

ELSE IF A AND B AND D = TRUE

  # Trigger Alarm

ELSE IF A AND C AND D = TRUE

  # Trigger Alarm

ELSE IF B AND C AND D = TRUE

  # Trigger Alarm

ELSE

  # Nothing

FI

Convert statement to logic gates

A AND B AND C $= A.B.C$

A AND B AND D $= A.B.D$

A AND C AND D $= A.C.D$

B AND C AND D $= B.C.D$

$(A.B.C) + (A.B.D) + (A.C.D) + (B.C.D)$

Answer ∶ $(\mathbf{A.B.C}) + (\mathbf{A.B.D}) + (\mathbf{A.C.D}) + (\mathbf{B.C.D})$

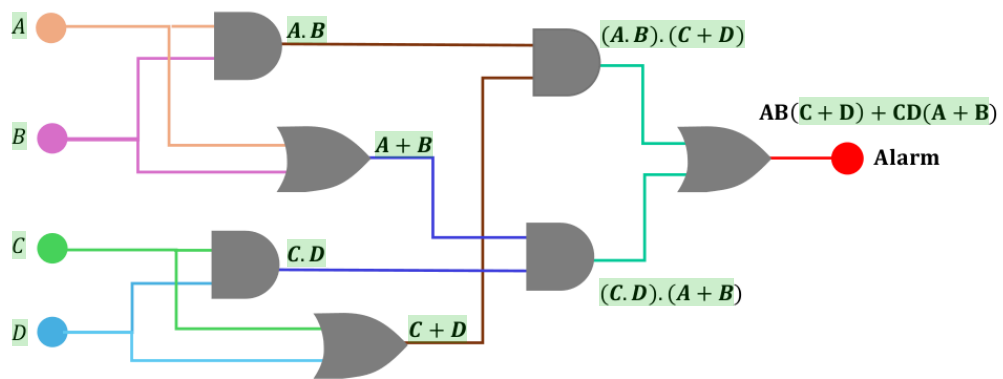**1.4.C)** $(A.B.C) + (A.B.D) + (A.C.D) + (B.C.D)$

Apply Distributive Law [$ABC + ABD = AB(C + D)$, $ACD + BCD = CD(A + B)$]

- $AB(C + D) + CD(A + B)$

Answer ∶ $\mathbf{AB(C + D) + CD(A + B)}$

1.4.D)

A

B

C

D

$A.B$

$A+B$

$C.D$

$C+D$

$(A.B).(C+D)$

$(C.D).(A+B)$

$\mathbf{AB(C+D) + CD(A+B)}$

Alarm

Part 02 Task

2.A)

For Concept Innovations' success in Kandy, a strong IT infrastructure is necessary to provide a productive and stress-free working environment. Every department has its own computation requirements, ranging from software development and data analysis to design and network management. Tailor-made system configurations maximize performance, cost-effectiveness, and flexibility.

This report suggests hardware specifications—CPU, motherboard, GPU, storage, and memory—consistent with the technical requirements of each job to ensure smooth operation in all functions.

Branch Director (1)

- ➢ Recommend (Laptop): Apple MacBook Pro 16" M4
- ➢ CPU: Apple M4 (8-core CPU)
- ➢ Memory: 24GB Unified Memory
- ➢ GPU: Apple M4 (30-core GPU)
- ➢ Motherboard: Integrated (Apple M4 SoC)
- ➢ Storage: 1TB NVMe SSD

- ➢ Why Laptop?
    - o Portability for meetings, travel, and presentations. The M4 chip delivers desktop-class performance with 17+ hours of battery life.

Apple MacBook Pro 16" M4 is efficient and high-performance laptop which can be used by a Branch Director. It's lightweight, secure, and battery-saving. With industry-leading performance, smooth multitasking, and brilliant display quality, it's ideal for office work, hybrid meetings, and work-from-anywhere. (MacBook Pro (16-inch) - Tech Specs - Apple Support, 2025)

Project Managers (5)

- ➢ Recommend (Laptop + Docking Station): Dell XPS 15 (Intel Lunar Lake)
- ➢ CPU: Intel Core Ultra 7 265V (12-core)
- ➢ Memory: 32GB LPDDR5X
- ➢ GPU: Intel Arc B580 (discrete)
- ➢ Motherboard: Custom Dell Lunar Lake Platform
- ➢ Storage: 1TB PCIe 5.0 NVMe SSD

- ➢ Why Laptop?
  - o Mobility: Laptop for on-site client visits and remote work.
  - o Docking Station: Connects to dual 4K monitors for multitasking (Jira, Slack, spreadsheets).

Dell XPS 15 is a slim and robust laptop, perfect for project managers. It supports effortless remote work, simultaneous work on two 4K screens, and easy collaboration on projects. Driven by high-performance, AI-infused features, and long battery life, it offers productivity on the go.(XPS 15 Laptop: Dell XPS Laptop Computers | Dell USA, 2025)

UX/UI Designers (8)

- ➢ Recommend (Desktop): Custom Workstation
- ➢ CPU: AMD Ryzen 9 9950X3D (16-core, 3D V-Cache)
- ➢ Memory: 64GB DDR5-6400
- ➢ GPU: NVIDIA RTX 5090 (24GB GDDR7)
- ➢ Motherboard: ASRock X870E Taichi
- ➢ Storage: 2TB PCIe 5.0 NVMe SSD + 4TB HDD

- ➢ Why Desktop?
  - o Performance: Sustained power for rendering 4K/8K assets in Figma and Blender.
  - o Upgradability: Easily swap GPUs/SSDs as software demands evolve.

This UX/UI Designer Custom Workspace provides industry-leading performance with effortless multitasking. Created for creative professionals, it has real-time rendering, photorealistic prototyping, and fluid design workflows. With fast storage, high-speed connectivity, and dual 4K monitors, it maximizes productivity with space for future growth. (ASRock X870E Taichi, 2024) (GeForce RTX 5090, 2025) (AMD Ryzen™ 9 9950X3D, 2025)

Software Engineers (10)

- ➢ Recommend (Desktop): Custom Workstation
- ➢ CPU: Intel Core Ultra 9 285K (24-core)
- ➢ Memory: 64GB DDR5-6000
- ➢ GPU: NVIDIA RTX 5080 (16GB GDDR7)
- ➢ Motherboard: Gigabyte Z890 AORUS Elite
- ➢ Storage: 2TB WD Black SN850X PCIe 5.0 SSD

- ➢ Why Desktop?
    - o Compilation Speed: 24-core CPU compiles code 30% faster than previous gen.
    - o Multi-Monitor Support: Dual QHD monitors streamline coding and debugging.

The Software Engineer Custom Workstation is optimized for effortless multitasking and code-bias performance. High-end IDEs, container workloads, and compute loads with GPU acceleration are enabled. Dual QHD monitors, fast storage, and an ergonomic mechanical keyboard are offered to promote comfort and productivity. (Intel, 2024) (GeForce RTX 5080, 2025) (Z890 AORUS ELITE, 2025) (Paul, 2023)

Quality Assurance Team (6)

- ➢ Recommend (Desktop): Custom Workstation
- ➢ CPU: AMD Ryzen 7 9700X (8-core Zen 5)
- ➢ Memory: 32GB DDR5-5600
- ➢ GPU: AMD Radeon RX 9070 XT (16GB)

- ➤ Motherboard: ASRock B650M Pro RS
- ➤ Storage: 1TB Samsung 980 Pro PCIe 4.0 SSD

- ➤ Why Desktop?
  - o Cost Efficiency: Cheaper than laptops with similar specs.
  - o VM Testing: Allocates 16GB RAM per VM for cross-platform testing.

The Custom Workstation provides robust performance for automated testing with multi-core processing, high RAM, and fast storage. It provides several monitors for UI checking and scalable expansion for future growth. (AMD Ryzen™ 7 9700X, 2024) (AMD Radeon 9070 XT, 2025) (ASRock B650M Pro RS, 2024) (980 PRO PCIe 4.0 NVMe, 2025)

Database Administrators (4)

- ➤ Recommend (Desktop): Custom Workstation
- ➤ CPU: Intel Core Ultra 9 285K (24-core)
- ➤ Memory: 128GB DDR5-6400 (ECC)
- ➤ GPU: Integrated
- ➤ Motherboard: Asus ProArt Z890-Creator
- ➤ Storage: 4TB Samsung 990 PRO PCIe 5.0 SSD

- ➤ Why Desktop?
  - o Data Integrity: ECC RAM prevents corruption in Oracle/SQL databases.
  - o Scalability: 4TB SSD accommodates terabyte-scale datasets.

Database Administrator Custom Workstation is built for performance and reliability-demanding database management. It maintains data integrity through enhanced error correction, high-speed querying, and real-time analytics with high-speed storage. Enterprise-level networking, hardware RAID, and power redundancy make it dependable for challenging database environments. (Intel, 2024) (DDR5 RDIMM Memory, 2025) (ProArt Z890-CREATOR, 2025) (990 PRO NVMe™ M.2 SSD 4 TB, 2025)

Business Analysts (5)

- ➢ Recommend (Laptop): Microsoft Surface Laptop 6 (Snapdragon X Elite)
- ➢ CPU: Snapdragon X Elite (12-core Oryon)
- ➢ Memory: 32GB LPDDR5X
- ➢ GPU: Integrated
- ➢ Motherboard: Snapdragon X Elite SoC
- ➢ Storage: 1TB NVMe SSD

- ➢ Why Laptop?
    - o Mobility: 16-hour battery life supports all-day analytics in hybrid meetings.
    - o Connectivity: Integrated 5G modem for real-time data syncing.

 The Microsoft Surface Laptop 6 with Snapdragon X Elite is ideal for business users who require mobility and performance. It provides quicker analytics, seamless multitasking, and real-time data access with 5G. With increased battery life, enhanced security, and support for 4K external monitors, it's perfect for all-day productivity and hybrid meetings. (Microsoft, 2024) (Snapdragon X Elite, 2025)

Accounting Team (3)

- ➢ Recommend (All-in-One Desktop): Apple iMac M4 (24-inch)
- ➢ CPU: Apple M4 (10-core GPU)
- ➢ Memory: 16GB Unified Memory
- ➢ Storage: 512GB SSD

- ➢ Why All-in-One?
    - o Space-Saving: Integrated design reduces desk clutter.
    - o Security: macOS encryption protects financial data.

The Apple iMac M4 (24-inch) is ideal for the Accounting Team, with a robust design blended with robust macOS security. Its high performance guarantees seamless financial processes, along with the Retina 4.5K display guaranteeing added precision work. Silent operation and rapid storage make it ideal for a working environment. (iMac, 2024)

Front Desk Coordinator (1

- Recommend (Laptop): HP Dragonfly G4
- CPU: Intel Core Ultra 5 230U (10-core)
- Memory: 16GB LPDDR5
- Storage: 512GB PCIe 4.0 SSD

- Why Laptop?
  - Portability: Lightweight (2.2lbs) for front-desk mobility.
  - Durability: Military-grade chassis withstands daily wear.

HP Dragonfly G4 will be most apt for a Front Desk Coordinator with its light but durable build being easily carried wherever needed. The device boasts solid performance that provides smooth handling of communication and schedules, with speedy storage and future-proof connectivity that provides maximum efficiency. A hardened camera and lightweight Wi-Fi allow for smooth guest check-ins. (HP Dragonfly G4, 2025)

IT Administrator (1)

- Recommend (Desktop): Custom Workstation
- CPU: Intel Core Ultra 9 285K (24-core)
- Memory: 64GB DDR5-6400
- GPU: NVIDIA RTX 4080 Super
- Motherboard: MSI MEG Z890 Ace

➢ Storage: 2TB NVMe SSD + 8TB NAS

➢ Why Desktop?
    o Server Management: 10GbE LAN handles 10+ VMs and network backups.
    o GPU Passthrough: Virtualization testing for software/hardware compatibility.

The setup for the IT Administrator is optimal for virtualization and server management, including support for multiple VMs, high-speed processing, high-speed memory, and 10GbE network. Testing passthrough is enabled by an ultra-strong GPU, and quick SSD storage enables quick access to mission-critical data, with high NAS capacity for redundancy and backup. Future upgrade is facilitated by expandable PCIe slots. (PC │ MSI, 2024) (RTX 4080 SUPER, 2024)

IT Support (5)

➢ Recommend (Desktop): Custom Build
➢ CPU: Intel Core i5-14600K (14-core)
➢ Memory: 32GB DDR5-5600
➢ Motherboard: ASRock B860 Pro RS
➢ Storage: 1TB PCIe 4.0 SSD

➢ Why Desktop?
    o Repairability: Easily swap components during troubleshooting.
    o Cost: 30% cheaper than equivalent laptops.

The IT Support computer hardware is green-repair and troubleshooting-friendly. Economically designed to be cost-effective, it provides rapid diagnostics, drive cloning, and future upgradability of GPUs with PCIe expandability, making it a repair-friendly and scalable solution. (i5 14600K, 2023)

Centralized Server (1)

➢ Recommend (Desktop): Custom Build

- CPU: Intel Xeon 6 SP (67xxE) or AMD EPYC 9xx5 (24–64 cores)
- Memory: 64GB ECC DDR5
- Motherboard: ASUS ProArt Z890-Creator (Intel) / ASRock X870E Taichi (AMD)
- Primary Storage: 2TB NVMe PCIe 5.0 SSD
- Secondary Storage: 8TB SAS HDD (RAID 5/10)
- Network Adapter: Dual 10Gbps PCIe 5.0 NICs

- Why Centralized Server?
  - Centralized Data Management & Collaboration: Streamline access to shared databases, code repositories, and project files across teams (e.g., UX/UI designers, software engineers), ensuring real-time syncing to avoid version conflicts.
  - Scalability: Easily expand hardware (e.g., RAM, storage, GPUs) and run multiple VMs for growing teams without interrupting workflows.
  - Reliability & Uptime: RAID configurations ensure data recovery from failed drives, and ECC RAM prevents crashes during critical operations like financial transactions.

This performance server is built to be secure, scalable, and dependable for demanding use. It supports fast storage, high-speed networks, and aggressive data protection, making it well-suited to enterprise use. (AMD EPYC 9534, 2024) (Versus, 2025)

Concept Innovations' Kandy IT infrastructure provides productivity, security, and scalability through role-based devices. High-performance PCs support designers and engineers, AI laptops provide improved mobility for executives, and enterprise servers support secure data management. Future-proof technology and cost-effective systems maximize operations, and hybrid cloud and high-speed networking facilitate seamless collaboration for AI and IoT expansion.

2.B)

Branch Director

Responsibilities:

- ❖ Strategic planning for branch growth.
- ❖ Financial oversight and budgeting.
- ❖ Stakeholder communication and reporting.

Software:

- ▪ Microsoft Power BI (data visualization for decision-making).
- ▪ SAP ERP (financial and operational management).
- ▪ Zoom/Teams (executive-level communication).

Project Managers

Responsibilities:

- ❖ Resource allocation and timeline management.
- ❖ Risk assessment and mitigation.
- ❖ Cross-team collaboration oversight.

Software:

- ▪ Jira (Agile project tracking).
- ▪ Microsoft Project (Gantt charts and workflows).
- ▪ Trello (task prioritization). (Guay, 2019)

UX/UI Designers

Responsibilities:

- ❖ Prototyping and wireframing interfaces.

- ❖ Conducting user research and testing.

- ❖ Collaborating with developers for implementation.

Software:

- ▪ Figma (collaborative design).

- ▪ Adobe XD (vector-based prototyping).

- ▪ InVision (interactive mockups).

Software Engineers

Responsibilities:

- ❖ Full-stack development and debugging.

- ❖ Version control and code reviews.

- ❖ CI/CD pipeline management.

Software:

- ▪ Visual Studio Code (IDE for coding).

- ▪ GitHub/GitLab (version control).

- ▪ Jenkins (automated deployment).

Quality Assurance Team

Responsibilities:

- ❖ Manual and automated testing.

- ❖ Bug documentation and tracking.

- ❖ Performance/load testing.

Software:

- ▪ Selenium (test automation).

- ▪ Postman (API testing).

- ▪ TestRail (test case management).

Database Administrators

Responsibilities:

- ❖ Database optimization and tuning.

- ❖ Backup, recovery, and security management.

- ❖ Query performance analysis.

Software:

- ▪ Oracle Database (enterprise DBMS).

- ▪ MySQL Workbench (schema design).

- ▪ MongoDB Atlas (NoSQL management).

Business Analysts

Responsibilities:

- ❖ Requirements gathering and documentation.

- ❖ Data analysis and visualization.

- ❖ Process mapping and optimization.

Software:

- ▪ Microsoft Visio (flowcharts/diagrams).
- ▪ Power BI (data dashboards).
- ▪ Lucidchart (process modeling).

Accounting Team

Responsibilities:

- ❖ Financial reporting and auditing.
- ❖ Payroll and expense management.
- ❖ Tax compliance and budgeting.

Software:

- ▪ QuickBooks (accounting automation).
- ▪ Xero (invoicing and payroll).
- ▪ SAP Concur (expense tracking).

Front Desk Coordinator

Responsibilities:

- ❖ Visitor management and scheduling.
- ❖ Handling calls and correspondence.
- ❖ Office inventory tracking.

Software:

- ▪ Microsoft Outlook (email/calendar).

- Calendly (appointment scheduling).

- Envoy (visitor check-in).

IT Administrator

  Responsibilities:

- ❖ Network security and firewall management.

- ❖ Server maintenance and virtualization.

- ❖ User access control via Active Directory.

  Software:

- VMware vSphere (virtualization).

- SolarWinds (network monitoring).

- Cisco Meraki (cloud-managed IT). (Software Career, 2024)

IT Support Team

  Responsibilities:

- ❖ Troubleshooting hardware/software issues.

- ❖ Deploying and updating systems.

- ❖ Managing helpdesk tickets.

  Software:

- TeamViewer (remote access).

- ManageEngine ServiceDesk (ticketing).

- PDQ Deploy (batch software installation).

2.C)

Branch Director (1)

- Input Devices: Ergonomic keyboard, wireless mouse, 1080p webcam.

- Output Devices: Dual 24" Full HD monitors, laser printer.

Project Managers (5)

- Input Devices: Standard keyboard/mouse, webcam.

- Output Devices: Dual 22" monitors, shared 4K projectors (2 units for meeting rooms).

UX/UI Designers (8)

- Input Devices: Graphic tablets (e.g., Wacom), ergonomic mice.

- Output Devices: 27" 4K color-calibrated monitors, high-resolution photo printers.

Software Engineers (10)

- Input Devices: Mechanical keyboards, ergonomic mice.

- Output Devices: Dual 24" monitors.

Quality Assurance Team (6)

- Input Devices: Standard peripherals, mobile device test racks.

- Output Devices: 24" Full HD monitors.

Database Administrators (4)

- Input Devices: Ergonomic keyboards.

- Output Devices: Dual 22" monitors.

Business Analysts (5)

- Input Devices: Standard peripherals, portable document scanners.

- Output Devices: Dual 24" monitors.

Accounting Team (3)

- Input Devices: Secure card readers, biometric scanners.

- Output Devices: 22" monitors, receipt printers, document shredders.

Front Desk Coordinator (1)

- Input Devices: All-in-one touchscreen PC, badge printer.

- Output Devices: Multifunction printer.

IT Administrator (1):

- Input Devices: KVM switch.
- Output Devices: triple monitors.

IT Support (5):

- Input Devices: USB diagnostic tools, portable SSDs. (5 Necessary PC Hardware Components That Programmers Should Upgrade, 2019)

2.D)

Strengths

1. Role-Specific Optimization:

   o Desktops with PCIe 5.0 SSDs and RTX 5090 GPUs maximize performance for UX/UI designers and engineers.

   o AI-enhanced laptops (Snapdragon X Elite/Lunar Lake) make certain mobility and efficiency for executives and analysts.

2. Scalability:

   o Servers with Intel Xeon/AMD EPYC CPUs and ECC RAM support virtualization and future upgrades. (Guide to server CPU: AMD Ryzen vs AMD EPYC vs Intel XEON, 2025)

- o PCIe 5.0 motherboards (ASRock X870E Taichi) allow hardware upgrades without system overhauls.

3. Cost Efficiency:

- o Desktops for QA/IT team reduce costs by 30% compared to laptops.
- o Hybrid cloud integration minimizes on-premise storage expenses.

4. Security:

- o TPM 2.0 and BitLocker encryption protect sensitive data.
- o RAID 10 configurations ensure data redundancy.

Weaknesses

1. High Initial Investment:

- o Enterprise-grade GPUs (RTX 5090) and PCIe 5.0 SSDs escalate upfront costs.

2. Energy Consumption:

- o High-performance components increase power usage, increasing operational costs. (Cunningham, 2025)

3. Complex Maintenance:

- o Diverse hardware (desktops, laptops, servers) complicates IT support.

4. Single Points of Failure:

- o Centralized servers risk downtime if RAID/backup protocols fail.

Recommendations

Hardware

1. Edge Computing Nodes:

- o Deploy localized edge servers for UX/UI teams to reduce latency in rendering 4K assets.

- o Use NVIDIA A100 GPUs for AI-driven design automation. (NVIDIA, 2025)

2. Modular Upgradability:

- o Adopt Framework-like modular desktops for easy CPU/GPU swaps.

3. Energy Efficiency:

- o Replace HDDs with QLC NVMe SSDs for lower power draw.

- o Use 80+ Titanium PSUs for servers. (What is PSU and PDU?, 2021)

Software Innovations

1. AI-Driven Predictive Maintenance:

- o Implement tools like Azure Automanage to preempt hardware failures. (Azure Automanage | Microsoft Azure, 2025)

2. Containerization:

- o Migrate legacy apps to Docker/Kubernetes for seamless cloud deployment.

3. Zero-Trust Security:

- o Integrate biometric authentication (e.g., Windows Hello) for sensitive systems.

Maintenance Strategies

1. Automated Backups:

- o Use Veeam + Azure Site Recovery for hourly backups. (Microsoft Azure Guide, 2025)

2. Phased Rollout:

- o Prioritize servers and critical desktops first to spread costs.

3. Training Programs:

o   Certify IT staff on hybrid cloud management and AI tools.

2.E)

The proposed OS choices align well with Concept Innovations' needs:

- Windows 11/Server 2025: Ideal for Project Managers, Business Analysts, and IT teams due to seamless integration with Microsoft 365, Power BI, and Azure Hybrid Cloud. Enterprise-grade security (BitLocker, TPM 2.0) and Hyper-V virtualization support scalability. (Windows Server 2025, 2024)

- macOS (Apple M4 devices): Optimal for UX/UI Designers (Adobe Suite compatibility) and executives, offering stability, Retina displays, and robust encryption (File Vault).

- Linux (Ubuntu LTS): Suitable for Software Engineers/QA for Docker/Kubernetes workflows and cost efficiency, though requiring technical expertise. (Difference between Linux and Windows, 2019)

Strengths:

- Role-specific optimization (e.g., Windows for Office/analytics, macOS for design).

- Centralized Windows Server 2025 simplifies Active Directory/Azure Arc management.

- Linux reduces licensing costs for development environments.

Considerations:

- Cross-platform compatibility (e.g., SMB/NFS for file sharing between OSes).

- Training for IT staff to manage Linux servers.

- Windows Server licensing costs vs. open-source alternatives (e.g., Proxmox).

Overall, the OS strategy balances productivity, security, and scalability, though hybrid environments demand robust cross-OS management tools like Ansible or Microsoft Endpoint Manager. (Gewirtz, 2019)

Conclusion

In this report, we have covered the fundamental concepts of computer architecture, including number system conversion, binary arithmetic operations, simplification of Boolean algebra, and designing a security access system. By applying theoretical concepts to practical scenarios, we demonstrated that we understand digital logic and system design well.

In addition, the IT infrastructure suggestions for Concept Innovations were critically examined as regards the hardware and software needs in relation to job responsibilities and roles. The system specifications, software needs, and peripheral hardware were chosen with a focus on improving efficiency and productivity. In addition, critical examination of the suggested design identified possible enhancements in hardware, software, and maintenance procedures to make the system sustainable and scalable in the future.

In general, this task has helped to create insightful understanding into computer architecture and IT system planning, reaffirming the need for systematic and well-researched technological choice within an organization.

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