

# Performance Benchmarking

**Group 28** 

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## Introduction

Performance benchmarking is a crucial process used to evaluate and compare various performance metrics of computing devices through standardized testing tools. This report focuses on assessing the performance of four laptops:

- ROG Zephyrus G14 (2023) a high end gaming notebook
- Asus Vivobook M1605YA a mid-tier notebook
- Apple MacBook Air (M3) an ultra-premium notebook
- Asus Vivobook S15 S533EQ another mid-tier notebook.

By using Geekbench, Cinebench, and Novabench benchmarking software tools to measure their CPU, GPU, memory, and storage capabilities.

The primary objectives of this study are:

- To analyze the performance metrics obtained from each benchmarking tool.
- To compare and interpret the results across the selected laptops.
- To determine which device delivers the best balance between performance and cost.

## Methodology

The benchmarking process was conducted to evaluate the overall system performance across key hardware components: CPU, GPU, memory, and storage. A standardized and repeatable procedure was followed to ensure fairness and accuracy of these results.

#### 1. Test Environment Setup

- All tests were performed on a clean system boot with minimal background processes running.
- Thermal conditions were monitored to prevent thermal throttling during the tests.

#### 2. Benchmarking Tools Used

- **Geekbench 6.5.0:** For evaluating CPU single-core and multi-core performance, as well as GPU compute capability.
- **Cinebench:** To measure CPU rendering performance under sustained workloads.
- **Novabench:** For assessing overall system performance, including CPU, GPU, Memory, and Storage.

#### 3. Test Procedure

- Each benchmark was run three consecutive times, and the average score was recorded to minimize random fluctuations.
- The system was allowed to cool for a few minutes between runs to maintain consistency.
- All benchmarks were performed under the default test settings provided by each software to ensure comparability with public results.

#### 4. Data Recording and Comparison

- The collected scores were compared with publicly available benchmark results for similar devices or processors (e.g., data from Geekbench Browser or NanoReview).
- Any anomalies or outlier results were noted and re-tested to verify accuracy.

#### 5. Evaluation Criteria

- **CPU Performance:** Measured in single-core and multi-core scores.
- **GPU Performance:** Evaluated via compute or graphics benchmark tests.
- **Memory Performance:** Measured in throughput and latency.
- Storage Performance: Assessed via read/write speed tests.

#### 6. Reporting

- Final results were summarized and presented with corresponding graphs or tables for comparison.
- The methodology ensures that all tests are reproducible and comparable with standard benchmark databases.

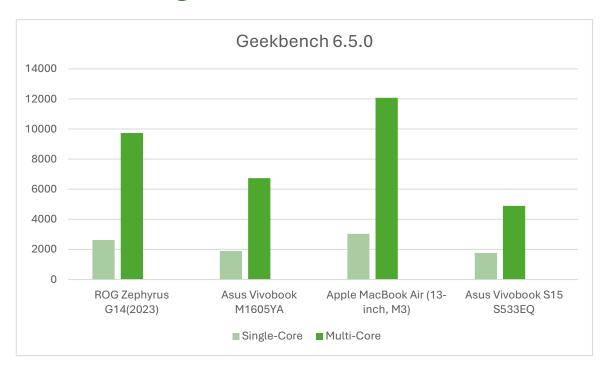
# **System specifications**

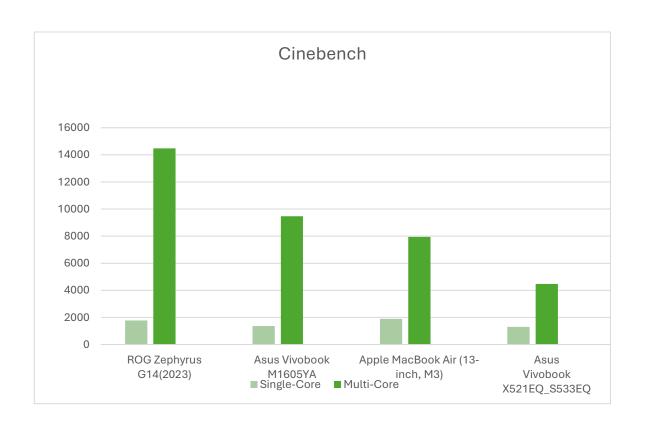
Device Name	ROG Zephyrus G14 (2023)	Asus Vivobook M1605YA	Apple MacBook Air (13-inch, M3)	Asus Vivobook S15 S533EQ	
Operating System	Windows 11 Home 64-bit	macOS Sequoia		Windows 11 Home 64-bit	
CPU	Ryzen 9 7940HS	AMD Ryzen 7 7730U	Apple M3 8-Core	Intel Core i7-1165G7	
GPU	NVIDIA GeForce RTX 4070 Laptop GPU	AMD Radeon (built in)	Apple M3 (Integrated 10-core)	NVIDIA GeForce MX350 4GB	
Memory	Memory 16 GB LPDDR5 16 GB DDR4		16 GB LPDDR5	8 GB DDR4	
Battery Life	5 to 7 hours	Up to 10 hours	15 to 18 hours	5 to 7 hours	
Price	Price Rs 940,000.00 Rs 220,000.00		Rs 344,900.00	Rs 230,000.00	

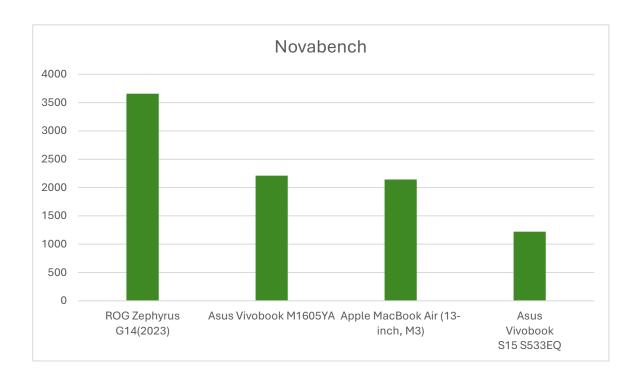
# **Benchmarking software comparison**

Benchmark	What it tests	Duration / Load	Strengths	Weaknesses
Geekbench	CPU, GPU	short tests (daily workloads)	Good for "burst performance"	Doesn't check sustained heavy loads much; Favours chips with high burst performance
Cinebench	Primarily CPU	Sustained heavy load (like rendering images)	Reveals how a CPU handles sustained full load and cooling capability	Doesn't test every aspect (like memory, storage, GPU)
Novabench	CPU, GPU, memory, storage	Moderate; not extremely long, but covers several subsystems	Gives a "balanced" view of overall system (not just the CPU)	Each individual test is lighter than dedicated ones

# **Benchmarking Results**







## **Analysis**

## **Geekbench Analysis**

#### ROG Zephyrus G14(2023)

- Single Core (On Battery: 2288 | Plugged In: 2630): Excellent single-core performance.
   The high plugged-in score indicates that the CPU can deliver full power when connected to a charger, while still maintaining strong efficiency on battery.
- Multi-Core (On Battery: 6655 | Plugged In: 9736): Outstanding multi-core performance, especially when plugged in. This allows the laptop to handle demanding workloads such as video rendering, programming with multiple threads and running virtual machines with ease.
- Overall: The ROG Zephyrus G14 (2023) delivers top-tier performance in both single and multi-core workloads. On battery, it still offers strong productivity performance, Ideal for power users, creators, and gamers who need both portability and high performance.

#### Asus Vivobook M1605YA

 Single-Core (On Battery: 1597 | Plugged In: 1902): Good single-core performance for everyday computing tasks such as web browsing, office applications, and light media use.

- Multi-Core (On Battery: 5863 | Plugged In: 6738): Moderate multi-core performance suitable for multitasking. However, it may slow down during intensive workloads like large video projects or heavy data processing.
- Overall: The Asus Vivobook M1605YA offers balanced performance for general use. It's
  efficient on battery and delivers better responsiveness when plugged in. Ideal for
  students though not designed for high-end gaming or heavy computational tasks.

#### Apple MacBook Air (13-inch, M3)

- Single-Core (On Battery: 3032 | Plugged In: 3036): Exceptional single-core performance that remains consistent whether on battery or plugged in. This means the M3 chip delivers full power without needing to be connected to a charger. Perfect for smooth and responsive everyday use, including browsing, and office work.
- Multi-Core (On Battery: 12031 | Plugged In: 12077): Outstanding multi-core results showing impressive efficiency and sustained performance.
- Overall: The MacBook Air (M3) delivers flagship-level performance with remarkable power efficiency. It maintains desktop-class speed even on battery, making it ideal for professionals, students, and creators who need both portability and performance.

#### Asus Vivobook S15 S533EQ

- Single-Core (On Battery: 941 | Plugged In: 1774): The single-core performance drops noticeably on battery, reflecting power-saving limits, but remains adequate for everyday tasks like web browsing, document editing.
- Multi-Core (On Battery: 2632 | Plugged In: 4903): Multi-core performance also halves on battery due to thermal and power restrictions, yet it can still handle moderate multitasking.
- **Overall:** The Vivobook S15 S533EQ performs well when plugged in, but battery mode significantly limits both single-core and multi-core performance. It's best for general productivity on battery and more demanding tasks when connected to power.

#### Cinebench

#### ROG Zephyrus G14(2023)

• Single-Core (On Battery: 1774 | Plugged In: 1775): The single-core performance remains almost identical in both modes, showing excellent consistency and efficient power management.

- Multi-Core (On Battery: 12,408 | Plugged In: 14,473): The multi-core score shows a noticeable boost when plugged in, indicating the CPU can unleash its full potential under higher power limits.
- **Overall:** The ROG Zephyrus G14 (2023) delivers top-tier Cinebench results for a compact laptop. It balances performance and portability impressively.

#### Asus Vivobook M1605YA

- Single-Core (On Battery: 1351 | Plugged In: 1370): The single-core scores are nearly identical in both modes, showing that the CPU maintains consistent performance regardless of power source.
- Multi-Core (On Battery: 9735 | Plugged In: 9471): The multi-core performance remains fairly balanced, with a small difference between modes.
- **Overall:** The Asus Vivobook M1605YA provides steady and efficient performance for everyday computing. It performs reliably on both battery and plugged-in power.

#### Apple MacBook Air (13-inch, M3)

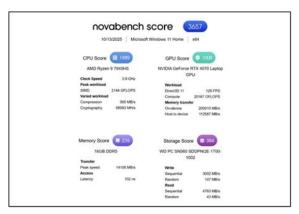
- Single-Core (On Battery: 1898 | Plugged In: 1899): The single-core performance remains perfectly consistent in both modes, showing Apple's excellent power efficiency and thermal optimization.
- Multi-Core (On Battery: 8859 | Plugged In: 7944): The multi-core scores show strong overall performance, with only minor variation between modes.
- **Overall:** The MacBook Air (M3) demonstrates impressive Cinebench results, maintaining high performance and energy efficiency on battery power.

#### Asus Vivobook S15 S533EQ

- Single-Core (On Battery: 637 | Plugged In: 1302): Single-core performance drops significantly on battery, reflecting power saving and thermal limitations. Plugged in, the CPU delivers strong single-threaded performance.
- Multi-Core (On Battery: 4385 | Plugged In: 4466): Multi-core scores remain nearly identical between battery and plugged-in modes, showing efficient power management and thermal design.
- **Overall:** The system maintains strong multi-core performance even on battery, though single-core tasks benefit greatly from being plugged in.

#### Novabench

#### ROG Zephyrus G14(2023)



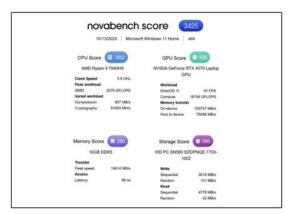


Fig: Plugged In

Fig: On Battery

**CPU (On Battery: 1852 | Plugged In: 1989):** Excellent performance for intensive tasks and multitasking, with very strong compression and cryptography throughput.

**GPU (On Battery: 908 | Plugged In: 1000):** High-performance NVIDIA GeForce RTX 4070 Laptop GPU; excellent for gaming, 3D rendering, and compute tasks.

**Memory (Peak: 14106 MB/s):** Fast 16GB DDR5 memory with low latency, ensuring smooth multitasking and efficient data handling.

**Storage (Read:4763 MB/s | Write: 3002 MB/s):** NVMe SSD provides very fast read/write speeds; minor performance differences between battery and plugged-in modes.

**Overall:** Outstanding CPU and GPU performance; memory is strong and stable, while storage remains fast in both modes, making this laptop excellent for demanding workloads.

#### Asus Vivobook M1605YA



Fig: Plugged In

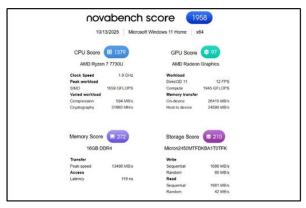


Fig: On Battery

**CPU (On Battery: 1379 | Plugged In: 1503):** Good performance for general and intensive tasks, with strong processing and efficient multitasking.

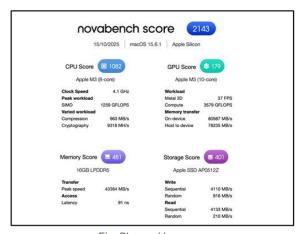
**GPU (On Battery: 97 | Plugged In: 98):** Low in both modes, likely using integrated graphics instead of the dedicated GPU.

Memory (Peak: 13981 MB/s): Strong and consistent, ensuring smooth data handling and responsiveness.

**Storage (Read: 3216 MB/s | Write: 3202 MB/s):** Very fast when plugged in, but slower on battery due to power-saving measures.

**Overall:** Excellent CPU and memory performance in both modes; storage slows on battery, and GPU remains underutilized.

Apple MacBook Air (13-inch, M3)





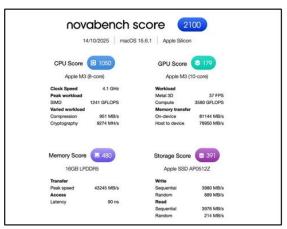


Fig: On Battery

**CPU (On Battery: 1050 | Plugged In: 1082):** Strong performance for general and intensive tasks, with high cryptography and compression throughput, and efficient parallel processing across 8-core Apple Silicon.

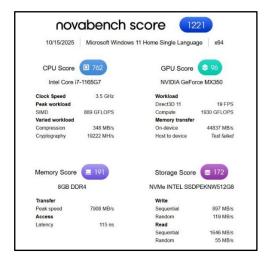
**GPU (On Battery: 179 | Plugged In: 179):** Moderate graphics performance; good for standard 3D and compute tasks but limited for heavy gaming.

**Memory (Peak : 43384 MB/s):** Very fast LPDDR5 memory with low latency, ensuring smooth multitasking and data handling.

**Storage (Read: 4133 MB/s | Write: 4110 MB/s):** Extremely fast SSD read/write speeds when plugged in; performance drops significantly on battery due to power-saving.

**Overall:** Excellent CPU and memory performance in both modes; GPU sufficient for everyday tasks, and storage shows a noticeable slowdown on battery.

#### Asus Vivobook S15 S533E



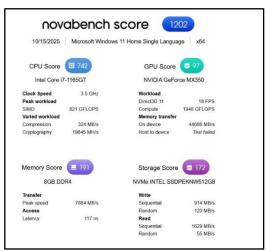


Fig: Plugged In

Fig: On Battery

**CPU (On Battery: 742 | Plugged In: 768):** Decent performance for general tasks and moderate workloads, with solid compression and cryptography scores; slight improvement when plugged in.

**GPU (On Battery: 97 | Plugged In: 96):** Low graphics performance; sufficient for basic computing and older games but not suited for demanding 3D tasks.

**Memory (Peak: 7908MB/s):** Average DDR4 memory speed; latency and bandwidth are moderate, affecting responsiveness in intensive multitasking.

**Storage (Write: 897MB/s | Read: 1646MB/s):** NVMe SSD provides good read/write speeds when plugged in; performance drops significantly on battery, especially in random writes.

**Overall:** CPU and memory are adequate for productivity; GPU is weak for graphics-heavy tasks, and storage slows on battery power.

## **Overall Comparative Analysis**

ROG Zephyrus G14 (2023)

The ROG Zephyrus G14 (2023) is a top-tier, high-performance laptop designed for power users and creators. It delivers excellent single-core and multi-core performance, making it capable of handling demanding workloads such as video rendering, 3D modeling, heavy multitasking, and programming with multiple threads. Its NVIDIA RTX 4070 Laptop GPU provides outstanding graphics performance, suitable for high-end gaming, 3D rendering, and compute-intensive tasks. Performance remains strong on battery, though plugging in allows the laptop to reach its full potential. Overall, the G14 is ideal for users who need a portable machine without compromising desktop-class power.

#### Apple MacBook Air (13-inch, M3)

The MacBook Air (M3) excels in efficiency and consistency, providing remarkable single-core and multi-core performance that remains nearly identical whether on battery or plugged in. Its strong single-core speed makes it ideal for coding, productivity, and creative tasks, while the multi-core performance supports seamless multitasking and moderate content creation. The GPU is moderate, handling standard 3D and creative workloads well but not suited for heavy gaming. The M3 chip's energy efficiency ensures low heat and silent operation, and memory performance is extremely fast. Storage is excellent when plugged in, though slightly limited on battery. Overall, the MacBook Air is perfect for students, professionals, and creators who prioritize portability, energy efficiency, and consistent performance for productivity and light creative work.

#### Asus Vivobook M1605YA

The Vivobook M1605YA provides balanced mid-range performance suitable for everyday computing tasks. Single-core and multi-core CPU performance are adequate for multitasking, office work. However, the GPU is weak, limiting performance in graphics-intensive tasks and gaming. This laptop is ideal for users seeking a reliable, efficient device for productivity and general computing but not for demanding content creation or high-end gaming.

#### Asus Vivobook S15 S533EQ

The Vivobook S15 S533EQ is a budget-friendly laptop that performs adequately for light to moderate computing tasks. Both single-core and multi-core performance drop significantly on battery, though plugged-in performance is substantially better, supporting moderate multitasking and productivity work. The GPU is limited, making it unsuitable for 3D graphics or gaming. Overall, it is suitable for students or professionals needing a basic, affordable laptop for web browsing, office work, and light content editing, but not for demanding applications or high-performance workloads.

Among the four laptops, the **ROG Zephyrus G14 (2023)** clearly leads in raw performance, offering the best CPU, GPU, memory, and storage capabilities. The **MacBook Air (M3)** stands out for efficiency, consistency, and excellent single-core performance. The **Vivobook M1605YA** offers a reliable mid-range experience for general use, while the **Vivobook S15 S533EQ** is suitable for basic productivity but limited in high-performance workloads.

# Internal Testing vs. Public Benchmarks

Device		ROG Zephyrus G14(2023)		Asus Vivobook M1605YA		Apple MacBook Air (13-inch, M3)		Asus Vivobook S15 S533EQ		
		On Battery	Plugged in	On Battery	Plugged in	On Battery	Plugged in	On Battery	Plugged in	
Our Results	Geekbench 6.5.0	Single- Core	2288	2630	1597	1902	3032	3036	941	1774
		Multi- Core	6655	9736	5863	6738	12031	12077	2632	4903
	Cinebench	Single- Core	1774	1775	1351	1370	1898	1899	637	1302
	Cinebench	Multi- Core	12408	14473	9735	9471	8859	7944	4385	4466
	Novabench		3425	3657	1958	2211	2100	2143	1202	1221
Public Results	Geekbench Core 6.5.0 Multi	Single- Core	~2419		~1857		~3000 – 3200		~1334	
		Multi- Core	~9881		~6344		~11500 to 12500		~4549	
	Cinebench Co	Single- Core	~1700 to 1805		~1400 to 1500		~1900		~1500	
		Multi- Core	~16700 to 17400		~7800 to 8000		~10000 to 10500		~5000 to 5200	
	Novabench		~3600 to 4000		~1500 to 1600		~1183		~954	
	Single- Geekbench Core		~ 8.7%		~ 2.4%		~ -2.1%		~ 32.9%	
	6.5.0	Multi- Core	~ -1.5%		~ 6.2%		~ 0.64%		~ 7.8%	
Average Difference	Cinebench -	Single- Core	~1.43%		~ -5.5%		~ -0.05%		~ -13.2%	
		Multi- Core	~ -15.1%		~ 19.9%		~ -22.5%		~ -12.4%	
	Novabench		~-3.7%		~ 42.6%		~ 81.2%		~ 25.6%	

## Performance/Price Ratio



Based on the graph, the **ASUS Vivobook M1605YA** has the highest performance-to-price ratio, making it the most cost-efficient option overall. However, despite its value, it is **not designed for high-end gaming or heavy workloads**, and it lacks battery efficiency and quieter operation.

The **ROG Zephyrus G14 (2023)** does not lead in performance per cost, but it is the **only laptop capable of running graphically intensive modern games** smoothly.

Its dedicated NVIDIA RTX GPU and powerful CPU make it ideal for **gaming.** 

The Apple MacBook Air (M3) stands out for its excellent power efficiency and consistent performance, even on battery. It is best suited for long working hours and quieter operation.

The **Vivobook S15 E533EQ**, on the other hand, performs decently but does not excel in any specific area compared to the others. It falls behind the Vivobook M1605YA in price efficiency and cannot match the MacBook's endurance or the ROG's performance.

## Evidence for the costs of different devices

ROG Zephyrus G14 (2023)

Price: LKR 940,000

At a high-end price of LKR 940,000, the ROG Zephyrus G14 (2023) is targeted at power users, gamers, and content creators who demand top-tier performance. Its exceptional CPU and GPU capabilities make it ideal for gaming. Fast memory and storage ensure smooth operation across all workloads. While costly, the laptop justifies the price for users seeking a portable machine with desktop-class performance.

#### Apple MacBook Air (13-inch, M3)

Price: LKR 344,900

Priced at LKR 344,900, the MacBook Air M3 offers excellent performance, energy efficiency, and portability. Its CPU excels in both single-core and multi-core workloads, while the GPU is sufficient for light creative and standard 3D tasks. The device also benefits from macOS optimization, long battery life, and premium build quality. For professionals, students, and creators who prioritize reliability, efficiency, and consistent performance, the MacBook Air provides good value at this price point.

#### Asus Vivobook M1605YA

Price: LKR 220,000

The Vivobook M1605YA, at LKR 220,000, is a mid-range option suitable for general-purpose computing. Its CPU and memory deliver solid performance for everyday tasks, office work, and light multitasking, though the GPU is limited. Storage speed is good when plugged in but slower on battery. Considering the affordability, this laptop offers

dependable performance for students or professionals who need a reliable device without spending heavily.

#### Asus Vivobook S15 S533EQ

**Price:** LKR 230,000

At LKR 230, 000, the Vivobook S15 S533EQ is a budget-to-mid-range laptop with adequate performance for basic tasks like web browsing, office applications, and light coding. Single-core and multi-core performance drop on battery, and the GPU is weak, limiting its suitability for gaming or graphics-intensive work. Storage performance is moderate, especially on battery. For users seeking a reliable laptop for light productivity and everyday use, this device offers reasonable value at its price

## General Observations and Conclusions

From the benchmarking tests conducted on the four devices ROG Zephyrus G14 (2023), Apple MacBook Air (M3), ASUS VivoBook M1605YA, and ASUS VivoBook S15 S533EQ the following general observations can be made:

#### 1. Performance:

- ROG Zephyrus G14 (2023) demonstrated the highest performance among all devices in both CPU and GPU-intensive workloads. Its multi-core and single-core scores were impressive, and the difference between plugged-in and battery modes was minimal. This makes it ideal for heavy multitasking, gaming, and professional-grade creative work such as video editing or 3D rendering.
- Apple MacBook Air (M3) showed excellent single-core efficiency and responsiveness, performing consistently in both plugged-in and battery conditions. While its GPU performance was not as strong as the ROG Zephyrus, it maintained smooth performance for productivity tasks, programming, and light creative workloads.
- ASUS VivoBook M1605YA delivered solid performance for its price range, handling everyday computing and multitasking effectively. The difference between plugged-in and battery results was very small, indicating good energy optimization. However, it may struggle under heavy workloads or advanced graphical tasks.
- ASUS VivoBook S15 S533EQ lagged behind the other three, showing lower CPU and GPU benchmark scores. Its performance is sufficient for basic computing, browsing, and office applications but not suitable for video rendering or gaming.

#### 2. Performance/Price Ratio:

 ROG Zephyrus G14, priced at LKR 940,000, delivers excellent performance but at a premium cost. It offers outstanding CPU and GPU capability, making it a powerful machine for professionals or gamers who prioritize performance over cost.

- Apple MacBook Air (M3), at LKR 344,900, provides strong single-core performance and exceptional efficiency for the price, especially for users in the Apple ecosystem. However, it may not be ideal for users requiring high-end GPU power.
- ASUS VivoBook M1605YA, priced at LKR 220,000, stands out as the best value-formoney option. It offers balanced performance, decent efficiency, and stable results on both power modes, making it ideal for students and professionals with moderate workloads.
- ASUS VivoBook S15 S533EQ, costing LKR 230,000, offers reasonable performance but doesn't fully justify its higher price, as it performs closer to the M1605YA.

#### 3. Conclusion:

In conclusion, the ROG Zephyrus G14 (2023) is the clear performance leader, best suited for users requiring high computational power and graphical performance. The Apple MacBook Air (M3) offers an excellent balance between performance, portability, and efficiency, making it ideal for professionals and students seeking a premium yet practical device. The ASUS VivoBook M1605YA provides the best price-to-performance ratio, offering reliable computing for everyday use. Meanwhile, the ASUS VivoBook S15 S533EQ, while serviceable, provides limited value compared to its cost and is more suited for light, general-purpose tasks.

### Recommendations

## 1. ROG Zephyrus G14 (2023):

- **Ideal for:** Power users, gamers, creative professionals, and those handling demanding workloads like 3D modeling, video editing, or programming.
- Why: Its exceptional single-core and multi-core performance, combined with strong GPU
  capability, make it perfect for both computational and graphical tasks. The consistent
  results in both battery and plugged-in modes highlight its efficient power management
  and performance stability.
- **Recommendation:** This is the top-tier choice for users seeking high-end performance without compromise. While it comes at a premium price, it fully justifies the cost for professionals and gamers who need reliable, top-performing hardware.

## 2. Apple MacBook Air (M3):

- **Ideal for:** Professionals, students, and developers who value portability, energy efficiency, and a smooth productivity experience.
- Why: The MacBook Air (M3) delivers excellent single-core performance and impressive battery life, making it ideal for tasks such as programming, photo editing, writing, and multitasking. Its optimized macOS environment ensures seamless operation and longterm reliability.

Recommendation: This is the best choice for users who want a balanced blend of
efficiency, design, and dependable performance within the Apple ecosystem. It's ideal for
productivity-focused users who prioritize battery life and a smooth, responsive workflow.

#### 3. ASUS VivoBook M1605YA:

- **Ideal for:** Students, office workers, and everyday users who want good performance at an affordable price.
- Why: The VivoBook M1605YA performs efficiently for daily computing needs such as browsing, document editing, streaming, and light multitasking. Its nearly identical performance in both battery and plugged-in modes shows strong optimization for power efficiency.
- **Recommendation:** This is the most cost-effective option, providing the best balance between price and performance. It's well-suited for users looking for a dependable and energy-efficient laptop for routine use without needing high-end features.

## 4. ASUS VivoBook S15 S533EQ:

- **Ideal for:** Casual users and professionals who need a stylish, moderately performing laptop for office work and general productivity.
- Why: The VivoBook S15 S533EQ offers acceptable performance for light to medium workloads, but its benchmark results indicate it's not intended for intensive computing or gaming. While it provides good build quality and reliable operation, its higher price compared to similar-performing models limits its value.
- **Recommendation:** This laptop is suitable for users who prioritize design and brand reliability over raw performance. It's best for everyday use but not the ideal choice for those seeking powerful multitasking or advanced graphics capabilities.

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## Contribution

- 230069A BALASOORIYA B.M.I.U
  - Running benchmarks
  - Preparing report
- 230135A DEWDUNIKA D.R.K.W.M.V.V
   Running benchmarks
   Preparing report
- 230272N JAYAMANNE J.M.A.N.N Running benchmarks Preparing report
- 230562E SAMARAKOON S.M.S.G Running benchmarks Preparing report
- 230717K WIJEPALA W.A.M.T.J.B Running benchmarks Preparing presentation