

Introduction to Computer Repair and Maintenance

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Quick reference guide for beginners and hobbyists

1. Why Maintenance Matters

Benefit	What It Prevents	Typical Impact
Longevity	Component wear, overheating	Extends useful life by 2-5 years
Performance	Software bloat, fragmented files	Faster boot, smoother multitasking
Reliability	Data corruption, sudden crashes	Fewer downtime incidents
Security	Unpatched OS/firmware	Reduced exposure to malware

2. Core Concepts & Terminology

Term	Definition	Example
POST (Power-On Self Test)	Diagnostic routine run by BIOS/UEFI at startup	Beeps or error codes if RAM fails
BIOS / UEFI	Firmware that initializes hardware & boots OS	Updating firmware can fix compatibility issues
Drivers	Software that translates OS commands to hardware actions	GPU driver updates improve graphics performance
Thermal Paste	Conductive compound between CPU/GPU and heatsink	Re-applying every 2-3 years prevents overheating
S.M.A.R.T.	Self-monitoring, analysis, and reporting technology for drives	Alerts you to impending HDD/SSD failure
Bootloader	Small program that loads the operating system	GRUB (Linux), Windows Boot Manager
Static Electricity	Charge buildup that can damage components	Use an anti-static wrist strap when handling parts

3. Preventive Maintenance Checklist (Monthly)

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1. Physical Inspection

- Check for dust accumulation on fans, vents, and heat sinks.
- Verify all cables are securely connected.
- Look for swollen capacitors or cracked solder joints.

2. Software Health

- Run OS updates (security patches, driver updates).
- Scan for malware with a reputable anti-virus tool.
- Clean temporary files (Disk Cleanup, ccleaner, `rm -rf /tmp/*`).

3. Storage Management

- Defragment mechanical HDDs (skip SSDs).
- Verify free space $\geq 15\%$ of total capacity.
- Run a quick S.M.A.R.T. health check (`smartctl -a /dev/sda`).

4. Performance Tuning

- Check startup programs (Task Manager ? Startup, `systemctl list-unit-files --type=service`).
- Benchmark CPU/GPU temps under load (e.g., HWMonitor, stress-ng).

5. Backup Verification

- Confirm last backup timestamp.
- Test restore of a small file set.

4. Common Issues & Diagnostic Steps

Symptom	Likely Causes	First-Line Diagnostic
Computer won't power on	Power supply failure, loose power cable, dead CMOS battery	Verify wall outlet, test PSU with paperclip method, replace CMOS battery
Random freezes / BSOD	Faulty RAM, overheating, driver conflicts	Run MemTest86, monitor temps, roll back recent driver updates
No display	GPU failure, monitor cable, BIOS video settings	Test with another monitor/cable, reseal GPU, reset BIOS (clear CMOS)

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Symptom	Likely Causes	First-Line Diagnostic
Slow boot	Too many startup services, failing hard drive, corrupted bootloader	Use systemctl --dry-run --full to analyze, run chkdisk or fsck, reinstall bootloader if needed
Overheating	Dust, dried thermal paste, obstructed airflow	