Suggested computer configurations for learning and teaching remotely

This guide is to advise individuals concerned with the performance of their current computer or who are planning to acquire a new personally owned computer. Check for recommendations from your academic program or school IT department for any additional suggestions or guidelines.

### Hardware

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Suggested</th>
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<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Computers with these specifications will support many computational needs but may struggle with more intensive tasks or when running multiple applications.</td>
<td>Computers with these specifications will offer acceptable performance for 3 to 4 years for many computational tasks.</td>
</tr>
<tr>
<td><strong>Operating System</strong></td>
<td>Windows 10 (Home)</td>
<td>Windows 10 (Pro, Education, or Enterprise)</td>
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<tr>
<td></td>
<td>MacOS Mojave 10.14</td>
<td>MacOS Catalina 10.15</td>
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<td></td>
<td>Linux (any actively maintained distro)</td>
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<tr>
<td><strong>Processor</strong></td>
<td>Intel Core i5 dual-core processor (7th Generation) or AMD Ryzen 5 1000 series</td>
<td>Intel Core i5 quad-core processor (8th Generation) or AMD Ryzen 5 2000 series or later generations. See optional equipment for additional suggestions.</td>
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<tr>
<td><strong>Memory</strong></td>
<td>8 GB</td>
<td>16 GB or more</td>
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<tr>
<td><strong>Hard Drive</strong></td>
<td>256 GB or larger hard drive or SSD</td>
<td>500 GB or larger solid-state drive (SSD)</td>
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<tr>
<td><strong>Network</strong></td>
<td>Wireless 802.11b/g/n and/or wired connection; Bluetooth 4.x or greater</td>
<td>Wireless 802.11 ac (a/b/g/n compatible) and/or wired connection; Bluetooth 5.0</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td><strong>Warranty</strong></td>
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<td></td>
<td>When acquiring a new computer consider purchasing least a three- or four-year extended warranty for parts and labor that includes on site or in store support.</td>
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#### Desktop computers

Desktops often offer superior performance and upgradeability for less cost, but this comes at the expense of portability. Desktops often do not include wireless networking in their standard configurations.

#### Low-power or budget-class computers

Some ultrabooks, 2-in-1, fanless, chromebooks, and budget laptops including the MacBook (Retina 12”) and MacBook Air (i3 processor versions) are built to reduce weight, battery life, and/or system cost at the expense of computing power. Computers with low power processors often work well for many activities, they may have difficulty supporting some common academic computing tasks: examples: Intel: Y-series, Core M, Celeron, Pentium Silver/Gold; AMD: Ryzen 3, A-series, E-Series, FX, Athlon
Software

- Microsoft Office (https://mso.harvard.edu/office-proplus-overview)
- OS-specific browsers are installed automatically – Edge on Windows computers, Safari on Macs. Chrome can be downloaded from Google and Firefox can be downloaded from mozilla.org
- Adobe Reader from get.adobe.com
- Zoom from zoom.us
- Check with your school IT department for other software that maybe needed or available to you.

Security requirements for all computers connecting to Harvard systems and network

- Maintain the operating system and software with upgrades and patches.
- Hard drive encryption and computer firewall
  - Windows: encryption: Bitlocker; Firewall: Windows Firewall or Windows Defender Firewall
  - Mac: encryption: FileVault; Firewall: Mac OS firewall
  - Linux: use native Linux disk encryption and firewall
- Antivirus/AntiMalware software. Examples: Windows Defender (Windows), Avast (Mac), Sophos (Linux)
- Personal device security guidelines

Other recommended and optional computer equipment

- A laptop screen with HD (1920x1080 pixel) resolution or better
- Intel i7 or i9 or AMD equivalent processors are required for displaying 49 thumbnails in gallery view on a single page when using Zoom
- Ear buds or headset with microphone with standard 3.5mm or USB connector or Bluetooth wireless connection.
- Web camera if your computer does not have a built-in camera.
- External monitor

Internet recommendations

- Minimum bandwidth of 600 Kbps (up/down) and recommended is 1.5 Mbps (up/down).
- Multiparty Zoom video calls using high-definition video require as much as 3.0 Mbps (up/down)
- Check your Internet bandwidth using Speedtest (Links to an external site.).
- If you are having trouble with your network or Zoom see https://huit.harvard.edu/files/huit/files/network_tips.pdf and https://huit.harvard.edu/files/huit/files/zoom_tips.pdf