IOI 2020 Contestant PC Manual

Last update: 2 Aug 2020

This is the IOI 2020 Contestant PC Manual. It specifies requirements, preparations, setup, testing, and operating procedures of the Contestant PC, and includes activities before, during, and after the IOI 2020 Contests.

Team Leaders must ensure that they fully understand and comply with the directions in this Manual. They must also read this Manual in conjunction with other documents provided by the IOI 2020 Organising Committee.

Background

IOI 2020 will be conducted as an online contest. This requires significant changes in the setup of contest infrastructure, including setup, preparation, and operation procedures.

In any other IOI, the host organising committee is ordinarily responsible for providing and supporting the entire contest infrastructure. This is, however, not practical when IOI 2020 is conducted online and remotely with decentralised contest participation venues. For IOI 2020, it is necessary for Teams to provide and support their local contest infrastructure.

The IOI 2020 Organising Committee is committed to ensuring a successful contest. We have made changes to the contest procedures and infrastructure to support decentralised online participation, while seeking to achieve the same Contest outcomes as any other IOI. We require the participation and support of all Teams to make this IOI possible.

Overview

Contestants will participate in IOI 2020 Contests from decentralised contest participation venues arranged for by their respective Teams in consultation with the IOI International Committee and IOI 2020 Organising Committee.

Contestants will use Contestant PCs provided for by their Team. The Contest PCs will be loaded with a Virtual Machine image (Contestant VM), which is installed with Ubuntu 20.04, provided by the IOI 2020 Host Technical Committee (HTC). Contestants must use this Contestant VM to connect to the Online Contest Environment, access the Contest Management System (CMS), read Task Statements, submit their task solutions, as well as write, test, and debug their programs. The CMS is also referred to as the Grading System.

The IOI 2020 Organising Committee is working on the following timeline.

Date	Activity	Action by Teams / Contestant
17 Jul	Release of this Manual	Read, understand, and start making preparations, in particular to get Contestant PCs ready for use.
19 Jul	Release of Contestant VM Beta 1	Load Contestant VM into the Contestant PC for testing. Check that editors, compilers, debuggers, other tools, as well as general OS features and configuration work

		well. Send all feedback by 26 Jul for consideration to include changes in the next Beta.
2 Aug	Release of Contestant VM Beta 2	Load Contestant VM into the Contestant PC for continued testing. Send all feedback by 9 Aug. There will be no more feature changes after 9 Aug.
16 Aug	Release of Contestant VM RC 1	This is a Release Candidate. Testing will now include VPN and use of the Online Contest Environment. Contestant login credentials will be distributed. Please send all bug reports by 23 Aug.
30 Aug	Release of Contestant VM RC 2	This is the final Release Candidate. Please send all critical bug reports immediately.
6 Sep	Release of Contestant VM GA	This is the GA Release, and will be the final version of the Contestant VM to be loaded in Contestant PC for IOI 2020 Contests. Teams should install and test immediately.
13 Sep	**Practice Day**	Turn on and get ready the Contestant PC and Contestant VM no later than 1 hour before the start of practice.
16 Sep	**Contest Day 1**	Turn on and get ready the Contestant PC and Contestant VM no later than 4 hours before the start of Contest.
19 Sep	**Contest Day 2**	Turn on and get ready the Contestant PC and Contestant VM no later than 4 hours before the start of Contest.

Setup and Preparations

Teams are encouraged to commence setup and preparations as early as possible. The same Contestant PC and network connection should be used for setup, testing, and actual IOI 2020 as far as practicable.

Contestant PC Requirements

The Contestant PC is the physical or host computer used to run the Contestant VM. The latter is a VMware virtual machine installed with Ubuntu 20.04 and other tools, provided by the HTC, and must be used by the Contestant to participate in the IOI 2020 Contest.

Teams must arrange for the Contestant PC. This may be a desktop computer or a laptop computer, and it must run VMware Workstation virtualisation software, or equivalent. We recommend the following minimum hardware requirements for the Contestant PC:

- Windows-compatible computer
- Intel 5th Generation Core processor or newer, minimum 2 cores/4 threads
- 8 GB of RAM

- 128 GB of free storage available
- Monitor display with at least 1024 x 768 screen resolution
- Installed with any edition of Windows 10 operating system, version 1903 or newer
- Installed with VMware Workstation Player 15.x or Workstation Pro 15.x

Please note the following restrictions apply:

- The Contestant PC must only have one display in use. An external monitor can be connected to a laptop only if the laptop's built-in display(s) is disabled.

The following are for Teams to manage at their discretion:

- Contestants may use their own computer rather than ones centrally arranged for by their Teams, as long as their Teams ensures that all directions in this Manual are adhered to.
- Contestants may use any non-programmable keyboard and mouse as long as their Team is satisfied they do not cause interference or inconvenience to other Contestants.
- While we do not mandate a maximum screen size or resolution, Teams should test and verify how well the Contestant VM performs as a guest in a virtual environment with maximised window or in full-screen mode.

We recommend that Teams prepare additional identical Contestant PCs as backup. They should be fully setup and configured, including with the Contestant VM, so Contestants have quick and easy access to a replacement in case they face a problem with their original Contestant PCs.

NOTE: Due to the use of unique per-Contestant VPN connections, each Contestant must have only one active Contestant VM running. Backup Contestant PCs must not run the Contestant VM until the Contestant is ready to switch over. The IOI 2020 Online Contest Environment will only accept one VPN connection per Contestant.

Contestant PC and VM Setup

Teams must ensure that the Contestant PCs run only operating system features and applications which are essential to participating in the IOI 2020 Contests. In the interest of a distraction-free experience and stable performance, the HTC recommends a fresh installation of Windows 10, such as through the "Reset this PC" feature in Windows 10, then subsequently to install applications that are required to participate in IOI 2020.

Messaging, collaboration, communication, and other cloud sharing applications must not run on the Contestant PC. This requirement must be enforced by Proctors during the Practice and actual Contests by monitoring the Contestant activities. It will be advantageous if technical enforcement can also be applied in the Contestant PC.

VMware Workstation hypervisor must be used to run the Virtual Machine for the Contestant VM. Teams can choose to use either VMware Workstation Player 15.x or Workstation Pro 15.x. VMware Workstation Player 15.x is available free of charge for non-commercial use.

Teams must ensure that the Contestant PC supports and has Intel VT-x enabled in the BIOS or UEFI configuration. This might be turned off by default on some computers. Intel VT-x is required for good performance when running Virtual Machines.

The Contestant PC must be configured to *not* sleep, suspend, hibernate, or power off automatically. This is important in order to allow the Contestant PC to be left running unattended, such as may be

desired to allow remote testing by HTC, or prepping the contest participation venue significantly ahead of contest start time due to local timezone challenges.

Teams must ensure that there are no attempts to "root" the Contestant VM, i.e. to gain any kind of unauthorised access to the contents of the Contestant VM. The Contestant VM must only be accessed and used by logging in to the Ubuntu desktop interface with the prescribed user account. The Contestant VM must not have any storage device attached to it, apart from the virtual disk provided as part of the VM image.

The HTC assumes the use of Windows 10 on the Contestant PC. While we are aware that VMware has equivalent virtualisation products for macOS and Linux, and will also run on non-Intel processors, Teams that choose to use those platforms have to be responsible to provide their own technical support, while still complying with all the directions in this Manual and other documents from the IOI 2020 Organising Committee.

Internet Connectivity Requirements

The IOI 2020 Online Contest Environment is hosted in Amazon Web Services (AWS) Cloud, in the Asia/Singapore region (ap-southeast-1).

Internet connectivity is clearly a very critical requirement. Teams are entirely responsible for their own Internet access and network reachability to IOI 2020 Online Contest Environment. To this end, Teams must carefully evaluate their options, especially if they face network reliability challenges in their locality or upstream network service provider.

There are two critical requirements for Internet connectivity:

- Bandwidth: At least a reasonably dedicated 15 Mbps bandwidth to each Contestant PC, enough for all to be streaming a 4K video from YouTube simultaneously.
- Network Firewall: Contestant PC must have outgoing access to DNS, HTTP, HTTPS, and TCP port 655. The latter is for VPN connection to the IOI 2020 Online Contest Environment.

Where possible, a wired Gigabit Ethernet connection to the Contestant PC is preferable. This will eliminate any risk of Wi-Fi interference or disruptions that may impact the Contestant.

We further recommend that Teams make plans for backup Internet connections, such as through different broadband Internet providers or using a 4G mobile hotspot. Please remember to check that the above Bandwidth and Network Firewall requirements are tested on these backup networks.

The reference to 4K video streaming above for bandwidth requirement is only meant to be a proxy for or comparison to heavy data transfer activities that may be required during IOI 2020. These activities will include downloading of large data sets, or live updating of the Contestant VM. We do not actually have any live video streaming requirements.

Other Setup Considerations

The IOI 2020 Organising Committee wants to emphasise that problems encountered at the decentralised contest participation venues are for Teams to manage on their own. Contestants will not receive any considerations for problems encountered at their decentralised contest participation

venues, including Internet access and network reachability to the IOI 2020 Online Contest Environment.

Teams are reminded to plan for the following scenarios:

- Hardware or software problems with the Contestant PCs
- Internet access or other network reachability problems
- Power supply, ventilation, or other building facilities problems at the decentralised contest participation venues
- Ready access to support staff (e.g. for network, building facilities, etc)

Testing

Several rounds of testing are planned, and Teams are strongly advised to participate in every one of them.

The timeline provided in the Overview lists releases for two Beta versions and two RC versions of the Contestant VM, before the final GA version to be used for the actual IOI 2020 Practice and Contests.

Contestant VM images are large, typically about 4 GB in size. Please plan sufficient time to download.

Contestant VM Beta Versions

The Beta versions of the Contestant VM are the first opportunities for Teams and their Contestants to familiarise themselves with the computing environment that will be used for IOI 2020 Contests. Teams should test the following:

- Check that VMware Workstation Player 15.x or Workstation Pro 15.x is installed.
- Check that VMware can import the Contestant VM; check that the Contestant VM can be powered on and the virtualised Ubuntu operating system succeeds in booting up.
- Check user interaction with the Contestant VM, in particular that keyboard and mouse inputs are working, and foreign keyboard layouts work correctly.
- Check that the required software in the Contestant VM, such as web browser, editors, compilers, debuggers, development environments, and various other tools, are installed and working.
- Check that Internet access from inside the Contestant VM, such as browsing external websites, is working.

Contestants should make use of this opportunity to thoroughly familiarise themselves with the computing environment. This is especially important since they will depend on and use it exclusively during the IOI 2020 Contests. In particular, Contestants should practice writing, compiling, testing, and debugging programs in this environment. It may be beneficial to use this Contestant VM for their IOI training practices.

Teams should provide feedback early. Feedback for Beta 1 must be submitted by 26 Jul for changes to be considered for inclusion in Beta 2. Feedback for Beta 2 must be submitted by 9 Aug for

consideration in RC 1. Feedback may include bug reports and feature requests. Our priority is to fix bugs.

Contestant VM RC Versions

Release Candidate (RC) versions of the Contestant VM are intended to be close to final, and no further feature requests will be considered. The focus for RC versions is to fix bugs. The primary change in the RC version is the addition of support of VPN connections to the IOI 2020 Online Contest Environment.

The live IOI 2020 Online Contest Environment will come online together with the release of RC 1 of the Contestant VM. This will give everyone, including Contestants/Teams and the IOI 2020 Organising Committee, the opportunities to fully test all components of the contest infrastructure.

Contestant login credentials for the IOI 2020 Online Contest Environment will be disseminated together with the release of the RC 1 version of the Contestant VM to enable testing of VPN connectivity.

Teams and, in particular, Contestants, should check that:

- VPN connection to the IOI 2020 Online Contest Environment works.
- Confirm Contestant credentials.
- Continue testing the computing environment in the Contestant VM.

Teams should provide feedback on bugs as early as possible. Bug reporting for RC 1 must be submitted by 23 Aug. Bug reporting for RC 2 must be submitted immediately. Feature requests will not be considered.

Final Preparations

The final GA version of the Contestant VM will be released on 6 Sep 2020. Teams are encouraged to download and install the Contestant VM as soon as possible, and begin verification that the Contestant PC and Contestant VM are working and ready for IOI 2020 Contests. Teams must ensure they are fully ready before IOI 2020 Practice.

We will still give the GA version a version number, e.g. GA 1, in case there is a need to differentiate from a further update. It is our plan that any emergency updates after GA 1 release will be applied as a live update/patch when the Contestant VM is online.

Contest Operations

The actual IOI 2020 Contest operations will run from 13 Sep 2020 to 19 Sep 2020.

Communications

The IOI 2020 Organising Committee will use Slack for mass communication with all Teams via their Team Leaders and Deputy/Adjunct Team Leaders during the Contest operations period. The Slack channel will go live with the release of the Contestant VM GA version.

Proctors are the Team Leaders and Deputy/Adjunct Team Leaders who are charged with proctoring responsibilities and duties at their respective contest participation venues.

During Practice and actual Contests, Contestants should use the CMS for all queries as far as is practicable. If it is necessary to communicate with HTC or HSC, they must request to do so via their Proctors.

Contestant Credentials

Contestant login credentials to the Online Contest Environment will be disseminated with the release of the Contestant VM RC 1. These credentials will serve two purposes:

- The primary use is for the VPN connection to the Online Contest Environment. When the VPN is connected, web browser access from the Contestant VM to the CMS will not require further authentication. Access to the CMS will not be available directly from the Internet; Contestants must use the VPN connection from inside the Contestant VM.
- In case of a problem with the VPN, the HTC will enable direct access to the CMS from the Internet. Teams will be informed of this change, and provided with instructions to disable the VPN in the Contestant VM. In this scenario, Contestants will use their credentials to login directly to the Contest Website.

Prohibitions on Contestant PC and VM

Teams must ensure that the Contestant VM is not used in any unauthorised manner. These rules apply strictly from the RC 1 version onwards:

- Ensure that there is no attempt to "root", or to gain root access to, the Contestant VM.
- Ensure that there is no attempt to read or write the Contestant VM's virtual disk contents outside of running the Contestant VM through VMware Workstation.
- Ensure that the Virtual Machine settings are not modified.
- No external devices are attached to the Contestant VM.

The HTC will verify the integrity of the Contestant VMs. Contestants found using Contestant VMs with unauthorised access or modifications will be disqualified. This applies to both Practice Day and Contest Days.

Teams must also ensure the following on the Contestant PC:

- There are no messaging, collaboration, communication, and other cloud sharing applications running.
- Suspend all operating system notifications, such as by turning on Focus Assist in Windows 10.

Practice Day

Practice Day will be the first, and likely only, full-scale live test of the entire IOI 2020 contest infrastructure. This is an important test which includes the decentralised contest participation venues.

The IOI 2020 Organising Committee expects all Contestants and their Proctors, along with any support from their Team, to participate in Practice Day. The IOI 2020 Organising Committee will not be responsible for problems arising from their absence from this practice. Contestants will not receive any consideration during Contest Day 1 and Contest Day 2 for problems that should have been caught earlier had their respective Teams fully participated in the Practice Day.

Teams are expected to conduct practice at the actual venue they will use for Contest Day 1 and 2. Teams should also involve all their technical support staff, and test their backup Contestant PCs, backup Internet access, and other technical infrastructure.

The HTC expects the Contestant VM to be running and connected to the IOI 2020 Online Contest Environment no later than 1 hour before the Practice start time. Teams should commence setup prior to that. If the local timezone makes this difficult, the Contestant PC and Contestant VM can be started at a convenient time the prior day, and ensuring that the Contestant PC does not sleep, suspend, hibernate or power off.

The schedule for Practice Day is as follows.

Time	Activity
1 hr before start	Teams must ensure that Contestant PCs and Contestant VMs are running and connected to the IOI 2020 Online Contest Environment the latest at this time.
15 mins before start	Switch Contestant VM to maximised window or full-screen mode. The "ioi" user account will be reprovisioned. Contestant may relogin; their screen will be locked after a successful login.
Start of Practice	Contest begins. Screen will be automatically unlocked.
1 hr after start	Teams may test out their backup plans, such as backup Contestant PCs, backup Internet access, etc.
End of Practice	Wait for confirmation.

Teams must endeavour to adhere to actual Contest procedures up to 1 hour after Practice Start, so that HTC can test the full contest infrastructure. Thereafter, Teams are free to test out their own failure scenarios.

The HTC may make arrangements with individual Teams if further tests are required following the Practice Contest.

Contestants must take note that their user account in the Contestant VM will be reset to a default state prior to Practice start. Any customised settings in the user account configured earlier will be lost. Contestants should familiarise themselves with any custom setups they need to do. This will be the same for each Contest Day.

Contest Day 1 and 2

Teams must ensure that their contest participation venues are fully prepared and ready no later than 4 hours before the start of the Contest. This includes turning on the Contestant PC and ensuring that the Contestant VM is running and connected to the IOI 2020 Online Contest Environment.

If the local timezone makes this difficult, the Contestant PC and Contestant VM can be started at a convenient time the prior day, and ensuring that the Contestant PC does not sleep, suspend, hibernate or power off.

All Team Leaders, their deputies, and adjuncts must be logged in to the IOI 2020 Slack Workspace and actively monitor announcements and other important communications from one hour before the contest starts until the contest is concluded.

The HTC requires the Contestant VM to be running and connected to the IOI 2020 Online Contest Environment no later than 4 hours before the Contest start time. Teams should commence setup prior to that. If the local timezone makes this difficult, the Contestant PC and Contestant VM can be started at a convenient time the prior day, and ensuring that the Contestant PC does not sleep, suspend, hibernate or power off. This time is essential for the HTC to perform integrity checks and live updates of the Contestant VM, and any delays may result in late start for the respective Contestant.

Teams are reminded that the Contestant VM must be the final GA version released by the HTC, and that there are no unauthorised access or modifications to the Contestant VM.

The schedule for Contest Day 1 and 2 are as follows.

Time	Activity
4 hrs before start	Teams must ensure that Contestant PCs and Contestant VMs are running and connected to the IOI 2020 Online Contest Environment the latest at this time.
15 mins before start	Switch Contestant VM to maximised window or full-screen mode. The "ioi" user account will be reprovisioned. Contestant may relogin; their screen will be locked after a successful login.
Start of Contest	Contest begins. Screen will be automatically unlocked.
End of Contest	Wait for confirmation.

Annex A: Contestant VM Software

The IOI 2020 Contestant VM is installed with Ubuntu 20.04 LTS and ubuntu-desktop-minimal package set.

Contestants can expect the following software, with the minimum versions stated below.

Compilers: openjdk 11.0.7 gcc 9.3.0	**Text editors and IDEs:** atom 1.48.0 codeblocks 20.03 eclipse 2019.12 emacs 26.3 geany 1.36 intellij-idea-community 2020.2 joe 4.6 kate 19.12.3 kdevelop 5.5.0 nano 4.8 Sublime 3211 vim 8.1.2269 Visual Studio Code
Debugger: gdb 9.1 ddd 3.3.12 valgrind 3.15.0 visualvm 1.4.3	
Interpreters: ruby 2.7 python 3.8.2	
Documentation: OpenJDK C/C++, STL Python3	**Other applications:** firefox 78.0.1 gnome-terminal 3.36.2 kconsole 19.12.3 byobu 5.133

Annex B: Using the Contestant VM

Importing and Running the Contestant VM

Run VMware Workstation Player. Click on "Open a Virtual Machine", locate the Contestant VM image (IOI2020-xxx.ova) in the file dialog, and click Open. Then, click Import in the Import Virtual Machine dialog that appears. You may customise the VM name or change the storage path at your discretion.

After the import is complete, you can start running the Contestant VM.

Note: The steps with VMware Workstation Pro will be almost identical, although the UI may be slightly different.

To run the Contestant VM, select the VM, then click Play virtual machine. When the VM has booted up, login using the default "ioi" account listed, and use the default password "ioi".

The Contestant VM runs like any ordinary installation of Ubuntu 20.04. For users unfamiliar with VMware, here are some quick points to take note:

- When the Contestant VM runs in windowed mode (i.e. alongside other applications on the Windows desktop), you may sometimes need to click inside the Contestant VM display to direct keyboard and mouse inputs into it. If you find your keyboard and mouse inputs "stuck" to the Contestant VM, just press Left-Control and Left-Alt simultaneously to "release" the keyboard and mouse back to Windows.
- Like a regular Ubuntu 20.04 computer, you should shutdown the computer in the proper manner. From the Ubuntu desktop, click on the power button in the top right corner, then "Power Off/Log Out", then "Power Off…". Then, confirm by clicking on the "Power Off" button.

First-Time Login to Contestant VM

From the RC 1 version onward, at the first login to the Contestant VM, and every subsequent login as long as you do not complete this step, you will be prompted to run the IOI Setup.
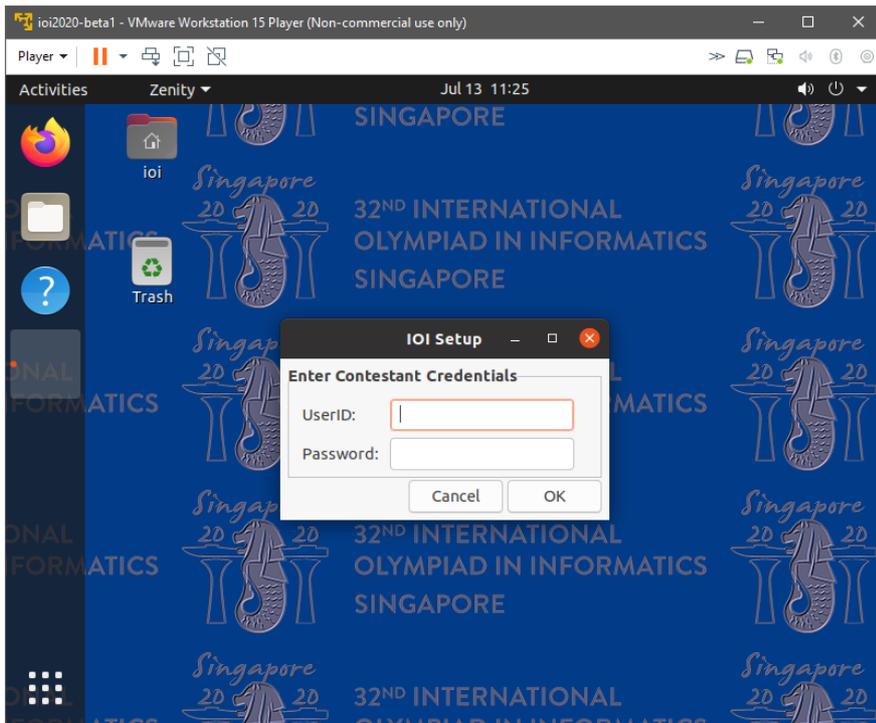
The IOI Setup script will request your Contestant credentials, then download and install a VPN configuration.

The Unix "gecos real name" is also updated with your Contestant ID, e.g. XXX1, which will be displayed in the top right corner on subsequent logins.

Contestants will still use the same Unix userid "ioi". However, do note that the Ubuntu desktop login screen will now display the "gecos real name", such as XXX1, after completing this IOI Setup.

The IOI 2020 Online Contest Environment will subsequently identify Contestants on the CMS website by the IP address assigned by the VPN. The website will not prompt for logins. Hence, it is important to ensure that Contestants are using the correct Contestant VM.

Contestants may, at their discretion, change the local Unix password for the "ioi" account in the Contestant VM. However, if the password is forgotten, a new Contestant VM will have to be provisioned.

General Information

The sidebar on the left is called the Launcher. The top icon in the Launcher is the Firefox web browser.

Firefox has been configured with a default homepage that provides links to the IOI 2020 Contest Website as well as other locally stored documentation.

The Show Applications icon, located at the bottom of the Launcher, shows all installed applications. You can use the search bar to quickly find an application by name. For example, you can easily find the gnome-terminal by starting to type the letters of "terminal".

Teams should ensure that they are familiar with finding and using the terminal shell. In case of unexpected problems, the HTC may send direction to Proctors to execute commands in a shell.