

## Exercises 1

1. Briefly describe the design aims of C++ and comment on the extent to which C++ meets those.

**Answer.** C++ was designed to combine the strengths of C as a systems programming language with Simula's facilities for organizing programs. To meet these two objectives, C++ was designed to be a *general-purpose programming language* with a bias towards *systems programming* that

- is a better C
- supports data abstraction
- supports object-oriented programming
- supports generic programming

2. What are the main programming styles supported by C++?

**Answer.** C++ supports:

- data abstraction, i.e., classes
- object-oriented programming, i.e., inheritance and polymorphism
- generic programming, i.e., templates

3. Check the following page: [www.stroustrup.com/applications](http://www.stroustrup.com/applications) and list 20 major real-world C++ applications.

**Answer.**

- (a) **Adobe Systems:** All major applications are developed in C++:

- Photoshop & ImageReady
- Illustrator
- Acrobat
- InDesign
- GoLive
- Frame (mostly C, some C++)

- (b) **Amazon.com:** Software for large-scale e-commerce.

- (c) **Apple:** OS X is written in a mix of languages, but a few important parts are in C++:

- Finder
- IOKit device drivers (IOKit is the only place where C++ is used in the kernel.)

- (d) **AT&T:** The largest US telecommunications provider.

- 1-800 service
- Provisioning systems
- Systems for rapid network recovery after failure

- (e) **Autodesk:** A large number of major applications in the CAD domain.

- (f) **Bloomberg:** Provides real-time financial information to investors.

- (g) **CERN**: Data analysis for large high-energy physics experiments using the ROOT toolset and libraries.
- (h) **Ericsson**:
  - TelORB – distributed operating system with object-oriented distributed RAM database
  - Base for the TSP application server platform
  - TDMA-CDMA HLR
  - GSM-TDMA-CDMA mobility gateway
  - AAA server
- (i) **Facebook (now Meta)**: Several high-performance and high-reliability components.
- (j) **Google**:
  - Web search engine
  - Chromium browser
  - Google File System
  - MapReduce large-cluster data processing
- (k) **HP (Hewlett-Packard)**: A small sample of HP's C++ applications:
  - C, C++, Fortran90 compilers, and linker for the HP IA64 platform (over 1M lines of C++)
  - SAM (system management utility)
  - Networking libraries in HP-UX
  - Java VM core
  - Parts of OpenView
  - Non-stop XML parser (originally from Compaq)
- (l) **IBM**:
  - OS/400
  - K42 – high-performance, open-source OS kernel for cache-coherent multiprocessors
- (m) **Intel**:
  - VTune performance analysis software
  - Compilers and optimizers
  - Various chip design and manufacturing software
- (n) **Microsoft**: Most products are built using Visual C++. Major products include:
  - Windows XP, Vista, 7, NT (NT4, 2000), 95, 98, Me
  - Microsoft Office (Word, Excel, Access, PowerPoint, Outlook)
  - Internet Explorer and Outlook Express
  - Visual Studio (C++, VB, FoxPro)
  - Exchange, SQL
  - Minor products: FrontPage, Money, Picture It, Project
  - Z3 (open-source theorem prover from Microsoft Research)
  - All Microsoft games
- (o) **MongoDB**: An open-source database used widely in web applications and large enterprises (e.g., Viacom, Disney).
- (p) **Morgan Stanley**: C++ is used extensively for financial modeling.

- (q) **Mozilla:** Firefox browser and Thunderbird mail client.
- (r) **MySQL:** MySQL Server (about 250,000 lines of C++) and MySQL Cluster.
- (s) **NASA:**
  - Mars rover autonomous driving system (scene analysis and route planning)
  - James Webb Telescope software
  - International Space Station software components
- (t) **Games:** *Warcraft III*, *World of Warcraft*.