SOFTWARE MAINTENANCE
ASSIGNMENT 2

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- 2K18/SE/041

Ques: Select any software package (traditional) that has at least 7-8 releases. For each release do the following:
  a. Categorize the changes in each release as minor/major changes.
  b. Classify the change (corrective/preventive/perfective/adaptive).
  c. Ponder upon the probable barrier(s) why a change was taken in a given release and could not be done in earlier releases?

ANDROID

Android is a mobile operating system based on a modified version of the <u>Linux kernel</u> designed primarily for touchscreen mobile devices such as smartphones and tablets. Android is developed by a consortium of developers known as the Open Handset Alliance and commercially sponsored by Google.

Android version History

Each & every release of Android version consists of many features and Google add all these features just to add more functionality in each release.

Android 1.0 (major change, Adaptive change)
Release date: 23 September 2008

Android 1.0, the first commercial version of the software, was released on September 23, 2008. The first commercially available Android device was the HTC Dream. Android 1.0 incorporated the following features:

- Android Market, allowing application downloads and updates through the Market application. Web browser to show, zoom and pan full HTML and XHTML web pages – multiple pages show as windows ("cards”)**.**

- Camera support – however, this version lacked the option to change the camera's resolution, white balance, quality, etc.

- Folders allowing the grouping of a number of application icons into a single folder icon on the Home screen.

- Access to web email servers, supporting POP3, IMAP4, and SMTP**.**

- Gmail synchronization with the Gmail application.

- Google Contacts synchronization with the People application.

- Google Calendar synchronization with the Calendar application.

- Google Maps with Street View to view maps and satellite imagery, as well as find local businesses and obtain driving directions using GPS.

- Google Sync, allowing management of over-the-air synchronization of Gmail, People, and Calendar.

- Google Search, allowing users to search the Internet and phone applications, contacts, calendar, etc.

- Google Talk instant messaging.

- Instant messaging, text messaging, and MMS. Media Player, enabling management, importing, and playback of media files – however, this version lacked video and stereo Bluetooth support.

- Notifications appear in the Status bar, with options to set ringtone, LED or vibration alerts.

- Voice Dialer allows dialing and placing of phone calls without typing a name or number.

- Wallpaper allows the user to set the background image or photo behind the Home screen icons and widgets.

- YouTube video player.

- Other applications include: Alarm Clock, Calculator, Dialer (Phone), Home screen (Launcher), Pictures (Gallery), and Settings. Wi-Fi and Bluetooth support.

Android 1.1 (minor change, corrective change)
Release date: 9 February 2009

The changes include:

- Details and reviews available when a user searches for businesses on Maps.

- Longer in-call screen timeout by default when using the speakerphone, plus the ability to show/hide the dialpad.

- Ability to save attachments in messages.

- Support added for marquee in system layouts.

Android 1.5 cupcake (major change, corrective change, perfective change)
This release introduced numerous refinements to the Android interface, including the first on-screen keyboard — something that'd be necessary as phones moved away from the once-ubiquitous physical keyboard model.

Version 1.5 was released on April 27, 2009. This update adds:

- Support for third-party virtual keyboards with text prediction and a user dictionary for custom words.
- Support for Widgets – miniature application views that can be embedded in other applications (such as the Home screen) and receive periodic updates.
- Video recording and playback in MPEG-4 and 3GP formats.
- Auto-pairing and stereo support for Bluetooth (A2DP and AVRCP profiles).
- Copy and paste features in web browser.
- User pictures shown for Favorites in Contacts.
- Specific date/time stamp shown for events in call log, and one-touch access to a contact card from a call log event.
- Animated screen transitions.
- Auto-rotation option.
- New stock boot animation.
- Ability to upload videos to YouTube.
- Ability to upload photos to Picasa.
- Ability to check phone usage history.

Android 2.0 Eclair (major change, perfective change)

This release's most transformative element was the addition of voice-guided turn-by-turn navigation and real-time traffic info — something previously unheard of (and still essentially unmatched) in the smartphone world.

On October 27, 2009, the Android 2.0 SDK was released, based on Linux kernel 2.6.29 and codenamed Eclair. Changes include the ones listed below:

- Expanded Account sync, allowing users to add multiple accounts to a device for synchronization of an email and contacts.
- Microsoft Exchange email support, with a combined inbox to browse an email from multiple accounts in one page.
- Bluetooth 2.1 support.
- Ability to tap a Contacts photo and select to call, SMS, or email the person.
- Ability to search all saved SMS and MMS messages, with the added ability to delete the oldest messages in a conversation automatically deleted when a defined limit is reached.
- Numerous new camera features, including flash support, digital zoom, scene mode, white balance, color effect and macro focus.
- Refreshed browser UI with bookmark thumbnails, double-tap zoom and support for HTML5.

- Optimized hardware speed and revamped UI.
- Support for more screen sizes and resolutions, with better contrast ratio.
- Improved Google Maps 3.1.2.
- Addition of live wallpapers, allowing the animation of home-screen background images to show movement.

Android 2.1 (minor change, corrective change, preventive change)
Release date: 11 January 2010

The changes include:

- Minor amendments to the API and bug fixes.

Android 2.2 Froyo (major change, perfective change, corrective change)
Release date: 10 May 2010

- Speed, memory, and performance optimizations.
- Integration of Chrome's V8 JavaScript engine into the Browser application.
- USB tethering and Wi-Fi hotspot functionality
- Option to disable data access over a mobile network.
- Quick switching between multiple keyboard languages and their dictionaries.
- Support for Bluetooth-enabled car and desk docks.
- Support for numeric and alphanumeric passwords.
- Support for file upload fields in the Browser application.
- The browser now shows all frames of animated GIFs instead of just the first frame only.
- Support for installing applications to expandable memory.
- Adobe Flash support.
- Support for high-PPI displays (up to 320 ppi), such as four-inch 720p screens.
- Gallery allows users to view picture stacks using a zoom gesture.

Android 2.2.1 (minor change, corrective change, preventive change)
Release date: 27 September 2010

The changes include:

- Bug fixes, security updates and performance improvements.

Android 2.2.2 (minor change, corrective change, preventive change)
Release date: 21 January 2011

The changes include:

- Minor bug fixes, including SMS routing issues that affected the Nexus One.

Android 2.3 Gingerbread (major change, corrective change, Perfective change)

On December 6, 2010, the Android 2.3 (Gingerbread) SDK was released, based on Linux kernel 2.6.35. Changes included:

- Updated user interface design with increased simplicity and speed.
- Support for extra-large screen sizes and resolutions (WXGA and higher).
- Faster, more intuitive text input on a virtual keyboard, with improved accuracy, better suggested text and voice input mode.
- Enhanced copy/paste functionality, allowing users to select a word by press-holding, copying, and pasting.
- New Download Manager, giving users easy access to any file downloaded from the browser, email, or another application.
- Support for multiple cameras on the device, including a front-facing camera, if available.
- Enhanced support for native code development.
- Audio, graphical, and input enhancements for game developers.
- Native support for more sensors (such as gyroscopes and barometers).

Android 2.3.1 (minor change, corrective change, preventive change)
Release date: 9 February 2011

The changes include:

- Several improvements and API fixes.

Android 2.3.2 (minor change, corrective change, preventive change)
Release date: April 28 2011

The changes include:

- Support for voice or video chat using Google Talk.
- Fixed a spontaneous reboot on Samsung Galaxy S Plus.

Android 2.3.3 (minor change, corrective change, preventive change)
Release date: July 25 2011

The changes include:

- Improved network performance for the Nexus S 4G, among other fixes and improvements.
- Fixed a Bluetooth bug on Samsung Galaxy S.
- Fixed a Wi-Fi crash on Samsung Galaxy S Plus.
- Improved the Gmail application.
- Camera software enhancements.
- Improved battery efficiency.

Android 2.3.4 (minor change, corrective change, preventive change)
Release date: September 2 2011

The changes include:

- Fixed a voice search bug.

Android 3.0 Honeycomb (major change, perfective change)

On February 22, 2011, the Android 3.0 (Honeycomb) SDK – the first tablet-only Android update was released, based on Linux kernel 2.6.3.The first device featuring this version, the Motorola Xoom tablet, was released on February 24, 2011. The update's features included:

- Optimized tablet support with a new "holographic" user interface (removed again the following year with version 4.2).
- Added System Bar, featuring quick access to notifications, status, and soft navigation buttons, available at the bottom of the screen.
- Added the Action Bar, giving access to contextual options, navigation, widgets, or other types of content at the top of the screen.
- Simplified multitasking – tapping Recent Applications in the System Bar allows users to see snapshots of the tasks underway and quickly jump from one application to another.
- Redesigned the keyboard, making typing fast, efficient and accurate on larger screen sizes
- Simplified, more intuitive copy/paste interface.
- Multiple browser tabs replacing browser windows, plus form auto-fill and a new "incognito" mode allowing somewhat anonymous browsing.
- Quick access to camera exposure, focus, flash, zoom, front-facing camera, time-lapse, and other camera features.
- Ability to view albums and other collections in full-screen mode in Gallery, with easy access to thumbnails for other photos.
- Hardware acceleration.
- Support for multi-core processors.
- Ability to encrypt all user data.

Android 3.1 Honeycomb (minor change, corrective change)
Release date: May 10 2011

The changes include:

- UI refinements.
- Connectivity for USB accessories (USB On-The-Go).
- Expanded Recent Applications list.
- Resizable Home screen widgets.

- Support for joysticks and gamepads.
- Support for HTTP proxy for each connected Wi-Fi access point.

Android 3.2 Honeycomb (minor change, corrective change)

Release date: July 15 2011

The changes include:

- Improved hardware support, including optimizations for a wider range of tablets.
- Increased ability of applications to access files on the SD card, e.g. for synchronization.
- Compatibility display mode for applications that have not been optimized for tablet screen resolutions.
- New display support functions, giving developers more control over display appearance on different Android devices.

Android 3.2.1 Honeycomb (minor change, corrective change, preventive change)

Release date: September 20 2011

The changes include:

- Bug fixes and minor security, stability and Wi-Fi improvements.
- Update to Android Market with automatic updates and easier-to-read Terms and Conditions text.
- Update to Google Books.
- Improved Adobe Flash support in browser.

Android 3.2.2 Honeycomb (minor change, corrective change, preventive change)

Release date: September 30 2011

The changes include:

- Bug fixes and other minor improvements for the Motorola Xoom 4G.

Android 4.0 Ice Cream Sandwich(major change, perfective change)

The SDK for Android 4.0.1 (Ice Cream Sandwich), based on Linux kernel 3.0.1,[114] was publicly released on October 19, 2011. Ice Cream Sandwich was the last version to officially support Adobe Systems' Flash player.

The introduced numerous new features:

- Major refinements to the "Holo" interface with the new Roboto font family.
- Separation of widgets in a new tab, listed in a similar manner to applications.

- Easier-to-create folders, with a drag-and-drop style.
- Pinch-to-zoom functionality in the Calendar.
- Integrated screenshot capture (accomplished by holding down the Power and Volume-Down buttons).
- Improved error correction on the keyboard.
- Ability to access applications directly from the lock screen.
- Improved copy-and-paste functionality.
- Better voice integration and continuous, real-time speech-to-text dictation.
- Face Unlock, a feature that allows users to unlock handsets using facial recognition software.
- Automatic syncing of browser with users' Chrome bookmarks.
- Data Usage section in settings that lets users set warnings when they approach a certain usage limit, and disable data use when the limit is exceeded.
- Ability to shut down applications from the recent apps list with a swipe.
- Improved camera application with zero shutter lag, time lapse settings, panorama mode, and the ability to zoom while recording.
- Built-in photo editor.
- Hardware acceleration of the UI.[123]
- 1080p video recording for stock Android devices.

Android 4.0.1 (minor change, corrective change, preventive change)
Release date: October 19 2011

The changes include:

- Fixed minor bugs for the Samsung Galaxy Nexus.

Android 4.0.2 (minor change, corrective change, preventive change)
Release date: December 16 2011

The changes include:

- Numerous bug fixes and optimizations.
- Improvements to graphics, databases, spell-checking and Bluetooth functionality.
- Calendar provider enhancements.
- Accessibility refinements such as improved content access for screen readers.

Android 4.1 Jelly Bean (major change, perfective change, corrective change)

Google announced Android 4.1 (Jelly Bean) at the Google I/O conference on June 27, 2012. Based on Linux kernel 3.0.31, Jelly Bean was an incremental update with the primary aim of improving the functionality and performance of the user interface. Android 4.1 Jelly Bean was released to the Android Open Source Project on July 9, 2012 and the Nexus 7 tablet, the first device to run Jelly Bean, was released on July 13, 2012.

The update introduced new features:

- Smoother user interface.
- CPU input boost.
- Enhanced accessibility.
- Bi-directional text and other language support.
- Expandable notifications.
- TLS v1.1 and v1.2 support added.
- Ability to turn off notifications on an application-specific basis.
- Shortcuts and widgets can automatically be re-arranged or re-sized to allow new items to fit on home screens.
- Improved camera application.
- Multichannel audio.
- Ability for other launchers to add widgets from the application drawer without requiring root access.

Android 4.1.1 (minor change, corrective change, preventive change)
Release date: July 9 2012

The changes include:

- Fixed a bug on the Nexus 7 regarding the inability to change screen orientation in any application.

Android 4.1.2 (minor change, corrective change, preventive change)
Release date: October 9 2012

The changes include:

- Lock/home screen rotation support.
- One-finger gestures to expand/collapse notifications.
- Bug fixes and performance enhancements.

Android 4.4 KitKat (major change, corrective change, perfective change)

Google announced Android 4.4 KitKat on September 3, 2013. KitKat debuted on Google's Nexus 5 on October 31, 2013, and was optimized to run on a greater range of devices than earlier Android versions, having 512 MB of RAM.

The update introduced new features:

- Refreshed interface with white elements instead of blue.
- Ability for applications to trigger translucency in the navigation and status bars.
- Optimizations for performance on devices with lower specifications, including zRAM support and "low RAM" device API.

- Wireless printing capability.
- WebViews are now based on the Chromium engine (feature parity with Chrome for Android 30).
- Expanded functionality for notification listener services.
- New framework for UI transitions.
- Sensor batching, step detector and counter APIs.
- Settings application now makes it possible to select default text messaging and the home (launcher) application.
- Audio tunneling, audio monitoring and loudness enhancer.
- Built-in screen recording feature (primarily for developers, as usage of ADB is required).
- Bluetooth Message Access Profile (MAP) support.
- Disabled access to battery statistics by third-party applications.
- Wi-Fi and mobile data activity (TX/RX) indicators are moved to quick settings.
- Disables text wrapping in the WebView browser component.

Android 4.4.1 (minor change, corrective change, preventive change)
Release date: December 5 2013

The changes include:

- Better application compatibility for the experimental Android Runtime (ART).
- Camera application now loads Google+ Photos instead of Gallery when swiping away from the camera view.
- Miscellaneous improvements and bug fixes.

Android 4.4.2 (minor change, corrective change, preventive change)
Release date: December 9 2013

The changes include:

- Further security enhancements and bug fixes.
- Removal of the "App Ops" application permissions control system, introduced in Android 4.3.

Android 4.4.3 (minor change, corrective change, preventive change)
Release date: June 2 2014

The changes include:

- Further security enhancements and bug fixes.
- Refreshed the Dialer app's interface.
- Updated the Chromium-based WebView to version 33 (screencasting to DevTools, HTML5 Canvas hardware acceleration performance improvements, vibration API, HTML5 form validation, and an HTML5 datalist).

Android 5.0 Lollipop (major change, perfective change)

Android 5.0 "Lollipop" was unveiled under the codename "Android L" on June 25, 2014, during Google I/O. It became available as an official over-the-air (OTA) update on November 12, 2014, for select devices that run distributions of Android serviced by Google, including Nexus and Google Play edition devices.

The introduced new features:

- Support for 64-bit CPUs.
- Recent activities screen with tasks instead of applications, up to a configured maximum of tasks per application.
- Support for print previews.
- Refreshed lock screen, no longer supporting widgets.
- Refreshed notification tray and quick settings pull-down.
- Searches can be performed within the system settings for quicker access to particular settings.
- Lock screen provides shortcuts to application and notification settings.
- Audio input and output through USB devices.
- Recently used applications are remembered even after restarting the device.[207]
- Addition of 15 new languages: Basque, Bengali, Burmese, Chinese (Hong Kong), Galician, Icelandic, Kannada, Kyrgyz, Macedonian, Malayalam, Marathi, Nepali, Sinhala, Tamil and Telugu.
- Tap and Go allows users to quickly migrate to a new Android device, using NFC and Bluetooth to transfer Google Account details, configuration settings, user data and installed applications.
- A flashlight-style application is included, working on supported devices with a camera flash.
- User-customizable priorities for application notifications.
- Smart lock feature.
- Updated emoji.

Android 5.0.1 (minor change, corrective change, preventive change)
Release date: December 2 2014

The changes include:
- A few bug fixes, including resolving issues with video playback and password failures handling.

Android 5.1 Lollipop (minor change, corrective change, preventive change)
Release date: March 2 2015

The changes include:

- Improvements and bug fixes to the Overview screen.
- Ability to join Wi-Fi networks and control paired Bluetooth devices from quick settings.
- Official support for multiple SIM cards.
- Device protection: if a device is lost or stolen it will remain locked until the owner signs into their Google account, even if the device is reset to factory settings.
- High-definition voice calls, available between compatible 4G LTE devices running Android 5.1.

Android 5.1.1 Lollipop (minor change, corrective change, preventive change)
Release date: April 20 2015

The changes include:

- Various bug fixes
- Native Wi-Fi calling support.

Android 6.0 Marshmallow (major change, perfective change)

Android 6.0 "Marshmallow" was unveiled under the codename "Android M" during Google I/O on May 28, 2015, for the Nexus 5 and Nexus 6 phones, Nexus 9 tablet.

The introduced new features:

- Contextual search from keywords within apps.
- App Standby feature.
- Alphabetically accessible vertical application drawer.
- Application search bar and favorites.
- Native fingerprint reader support.
- Direct Share feature for target-specific sharing between apps.
- Renamed "Priority" mode to "Do Not Disturb" mode.
- Larger Application folders with multiple pages.
- USB-C support.
- Demo Mode feature for screenshot-capture usage.
- Automatic full data backup and restore for apps.
- 4K display mode for apps.
- Experimental multi-window feature.
- Support for actions by third-party apps in the text selection menu.
- App permissions now granted individually at run-time, not all-or-nothing at install time. Similar to App Ops.
- No screen rotation during touch.

Android 6.1 (minor change, corrective change)

Release date: December 7 2015

The changes include:

- Unicode 7.0 & 8.0 emoji support.
- Descriptions for USB connection options.
- Double-press the power button to open the camera.

Android 7.0 Nougat (major change, perfective change)

Android "Nougat" (codenamed N in-development) is the seventh major release of the Android operating system. It was first released as a developer preview on March 9, 2016, with factory images for supported Nexus devices, as well as with the new "Android Beta Program" which allows supported devices to be upgraded directly to the Android Nougat beta via an over-the-air update. The final release was on August 22, 2016.

The introduced new features:

- Support for file-based encryption.
- Unicode 9.0 emoji and skin tone modifier support
- Ability to display color calibration.
- Ability to zoom in the screen.
- Ability to switch to the last opened app by double-tapping the overview button.
- Added an Emergency information part.
- Added the "Clear All" button to the Overview screen.
- Daydream virtual reality platform (VR interface).
- Improvements to the file browser.
- More Quick Settings options.
- Multi-window support, which supports floating apps on a desktop layout.
- New Data Saver mode, which can force apps to reduce bandwidth usage.
- Picture-in-picture support for Android TV.
- Redesigned notification shade, featuring instant access to certain settings.
- Settings app navigation drawer.

Android 7.1 (major change, corrective change)

Release date: October 4 2016

The changes include:

- "Restart" option added to power button menu
- Touch/display performance improvements.
- Moves (Fingerprint swipe down gesture – opt-in).

- Developer features:
  - Shortcut manager APIs.
  - Circular app icons support.
  - Fingerprint sensor gesture to open/close notification shade.
  - Enhanced wallpapers.
  - Multi-endpoint call support.
- Manual storage manager – identifies files and apps using storage.

Android 7.1.1 (minor change, corrective change)

Release date: December 1 2016

The changes include:

- New set of emojis adding different skin tones and haircuts to existing ones.
- Send GIFs directly from the default keyboard.
- App shortcuts: Launch actions on apps by long-pressing the app icon.
- Developer Options: Show CPU Usage feature removed.

Android 7.1.2 (minor change, corrective change)

Release date: April 2 2017

The changes include:

- Battery usage alerts.

Android 8.0 Oreo (major change, perfective change)

Android Oreo is the eighth major release of the Android operating system. It was first released as a developer preview, codenamed Android O, on March 21, 2017, with factory images for supported Nexus and Pixel devices. The final developer preview was released on July 24, 2017, with the stable version released in August 2017.

The introduced new features:

- Picture-in-picture support.
- Support for Unicode 10.0 emoji (5.0) and replacement of all blob-shaped emojis by round ones with gradients and outlines.
- Redesigned Quick Settings and Settings with a white background and respectively black and Accent font colors.
- Restructured Settings by regrouping sections into similar entries.
- Adaptive icons
- Notification improvements.

- Notification dots (badges).
- Notification snoozing.
- App-specific unknown sources.
- Multi-display support.
- Apps background execution and location limits.
- Google Play Protect.
- Downloadable fonts.
- Integrated printing support.
- Wi-Fi Assistant.

Android 8.1 Oreo (major change, corrective change, perfective change)

Android 8.1 Oreo is the sixteenth minor release of the Android operating system. It was first released as a developer preview on October 25, 2017, with factory images for current Nexus and Pixel devices. A second developer preview was made available on November 27, 2017, for Nexus and Pixel devices, before the stable version was released on December 5, 2017.

The introduced new features:

- Bluetooth battery level for connected devices, accessible in Quick Settings.
- Android Oreo Go Edition, a lightweight distribution of Android that runs better than normal Android on devices with less than 1 GB of RAM.
- Autofill framework updates.
- Programmatic Safe Browsing actions.
- Visual changes to 'Power Off' and 'Restart', including a new screen and floating toolbar.
- Automatic light and dark themes.