This is CS50
Getting hydration from a MIT is like trying to get a drink from a fire hose.
2/3 of CS50 students had never taken CS before.
what ultimately matters in this course is not so much where you end up relative to your classmates but where you end up relative to yourself when you began
```c
#include <stdio.h>

int main(void)
{
    printf("hello, world\n");
}
```

```shell
$ make hello
```
1100

Relays changed

1525

Started Cosine Tape (Sine chest)

Started Multi-Adder Test.

1545

Relay #70 Panel F (moth) in relay.

First actual case of bug being found.

1630

Antennae started.

1700

Closed down.
#include <stdio.h>

int main(void)
{
    printf("hello, world\n");
}

print("hello, world")
<!DOCTYPE html>
<html lang="en">
  <head>
    <title>
      hello, title
    </title>
  </head>
  <body>
    hello, body
  </body>
</html>
Headlines

Past headlines

For headlines posted prior to the past seven days, click here.
$
CS50 Hackathon
CS50 Fair
Thank you
Office for the Arts at Harvard
Memorial Hall / Lowell Hall Hall Complex
computational thinking
critical thinking
input → [blank] → output
correctness, design, style
abstraction
precision
Hi
Install command-line tools

https://developer.apple.com/xcode/
https://learn.microsoft.com/en-us/windows/wsl/about
...
Learn Git

https://youtu.be/MJUJ4wbFm_A

...
Download VS Code

https://code.visualstudio.com/
Host a web site

https://pages.github.com/
https://www.netlify.com/
...
Host a web app

https://aws.amazon.com/education/awseducate/
https://azure.microsoft.com/en-us/free/students/
https://cloud.google.com/edu/students

https://education.github.com/pack

...
Keep reading

https://www.reddit.com/r/learnprogramming/
https://www.reddit.com/r/programming/
https://stackoverflow.com/
https://serverfault.com/
https://techcrunch.com/
https://news.ycombinator.com/
...

Stay in touch

cs50.harvard.edu/x/communities
CS50 Quiz Show
The World of Emoji

Harvard CS50 • November 2022
Jennifer 8. Lee • Emojination
Fried Dumplings!!!! Yum! 😍😍😍

We can make those tmw

Yay!! 🍴🍴🍴🍴 I'm surprised Apple doesn't have a dumpling emoji...

Oh. Good point
I decided to carry the emoji torch!

Haha. Did you make that?

Yep
Who Controls Emoji?
$18,000
$75.00
The room where it happens.
Shadowy
Emoji
Overlord
THE DUMPLING EMOJI PROJECT

Emoji by The People, for The People
Art created by Yijing Lu. Licensed for non-commercial use: free to share and use.

Dumpling Emoji Submission
To: Unicode Consortium
From: Jennifer S. Lee, Yiying Lu, Kenny Lao, Namrata Mujumdar, and Emojination
Date: January 19, 2016

Abstract
We are requesting the addition of a dumpling emoji, or more generally an emoji for "dough skin wrapped around a filling." A dumpling glyph would fill a notable gap in the current emoji set and serve as a good "stem" emoji for related foods down the line. The formal name could be DUMPLING, with aliases that include POTSTICKER, GYOZA, JIAOZI, PIEROGI, and EMPANADA.

Introduction
Dumplings are one of the most pervasive foods in the world, culinarily native to four continents and served on all seven continents, including Antarctica.¹ As History.com

---

Submitting a Emoji Character Proposal

Submit Here

- Is the emoji an overly specific member of a more general class?
  - No
- Is the emoji from a relatively open-ended set?
  - Yes
  - No
- Can the emoji be represented by another emoji or sequence?
  - Yes
  - No
- Does the emoji represent a logo, brand, UI icon, signage, or specific person/deity?
  - Yes
  - No

Some useful examples (U+XXXXXX) for possible new emoji. None of these have been proposed for inclusion yet.

Selection Facts

Initially, the Unicode standard was broadened to include new emoji. None of the existing emojis have been proposed for deletion or encoding yet. Most of the emojis are expected to be used for a long time, but some have been removed from popular platforms.

The candidate emoji may not be suitable for encoding. Please submit a proposal.

The candidate emoji may be suitable for encoding. Please submit a proposal.
Emoji Subcommittee
Factors for Inclusion

- Popular demand, frequently request (+)
- Multiple usages/meanings (+)
- Visual distinctiveness, can be recognized (+)
- Filling gap, “completeness” (+)
- Existing vendor compatibility (+)
Factors Against Inclusion

- Too specific, narrow (-)
- Redundant (-)
- Not visually discernible (-)
- No logos, brands, deities, celebrities (-)
- No more flags (X)
18-24 months (or more)
Why does Unicode control emojis?
1999 • Docomo
Enable everybody, speaking every language on the Earth, to be able to use their language on computer and smartphones.
Three main projects

• Encoding characters (including emoji!) — now over 100,000 assigned

• Localization Resources (Common Locale Data Repository, “CLDR”)

• Programming Libraries (International Components for Unicode, “ICU”)
Three main projects

• Characters (including emoji)
• Languages (CLDR)
• Programming Libraries
SEALDEER = CLDR
A Unicode **code point** is a unique number assigned to each Unicode character.
2011
What does 🙃 emoji mean?
😍 meaning from a guy
😍 meaning from a girl
what does 😍 mean from a guy
what does 😍 mean flirting
upside down face text
upside down smiley alt code
emojipedia
😊 meaning
Who Can Propose Emoji?
Google Form! April-August (recently)
UTC Document Submission: Hijab Emoji

To: UTC
From: Rayouf Alhumedhi
Date: 09/26/16

In the age of digitalization, pictures prove to be a crucial element in communication. Emoji’s are more impactful and utilized than ever before. Millions use them to convey feelings, appearances and stories. I applaud Unicode for the diversification of emoji’s in recent years. However, this does not mean it should stop now. With the amount of difference in this world, we must be represented. I’m here to discuss the addition of a woman wearing a headscarf emoji.

Roughly 550 million Muslim women on this earth pride themselves on wearing the hijab. With this enormous number of people, not a single space on the keyboard is reserved for them. Most obviously, women wearing the hijab aren’t mutually exclusive to one skin tone, so with the help of the Fitzpatrick Modifier, we would be able to develop an emoji that represents religious and racial diversity.
Proposal to Add Emoji:
Face With One Eyebrow Raised

Maximilian Merz, unicode@mxmerz.de

November 5, 2015

Abstract
Currently, there is no emoji encoded in Unicode that shows a face with one raised eyebrow. A raised eyebrow is a widely used facial expression and equally widely recognized as conveying a variety of meanings, centered around scepticism, surprise, disagreement, and being impressed. This proposal presents evidence of high usage of emoticons expressing similar mimics, suggesting a high expected usage level for the suggested emoji. An emoji with the name FACE WITH ONE EYEBROW RAISED is proposed to be included in the Unicode standard.

1. Introduction
10. ONE-PIECE SWIMSUIT

Why? A person wanting to indicate the use of swimwear can’t use the existing BIKINI?

Is this really necessary?

What about a Victorian bathing costume?

Or a wetsuit? Or water wings?

Do not encode.
Art created by Bruno Leo Ribeiro

**Sauna Emojis Submission**
To: Unicode Consortium
From: Ministry for Foreign Affairs of Finland (co-ordinator Petra Theman, Director of Public Diplomacy)
Date: 13.05.2016

**Abstract**

We are requesting the addition of the sauna emojis, both male and female person going into sauna. The sauna emojis would fill a notable gap in the current emoji set and serve as an important addition to activity, people and location emojis. The formal names could be SAUNA MAN and SAUNA WOMAN.
Person in Steamy Room
Expanding Emoji Professions: Reducing Gender Inequality

Contact: Rachel Been (been@google.com), Nicole Bleuel (nbleuel@google.com), Agustin Fonts (afonts@google.com), Mark Davis (markdavis@google.com)

Introduction

Google wants to increase the representation of women in emoji and would like to propose that Unicode implementers do the same. Our proposal is to create a new set of emoji that represents a wide range of professions for women and men with a goal of
Emojination Emoji
Why care?
林
林
林 木 木
林 林 林
林 木 木 木
明
明
明日月
家
家
家
家
女
安
安
安
亡
女
安

亡

女

女
女
女
奴
奸

茄子
Underneath the Hood
The Power of Combining Emoji
“ZWJ”
<table>
<thead>
<tr>
<th>Profession</th>
<th>Gender</th>
<th>Emojis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming</td>
<td>Woman</td>
<td>🧱 + 🚜 + [U+1F469] + [U+1F69C]</td>
</tr>
<tr>
<td></td>
<td>Man</td>
<td>🧱 + 🚜 + [U+1F468] + [U+1F69C]</td>
</tr>
<tr>
<td></td>
<td>Farmer</td>
<td></td>
</tr>
<tr>
<td>Food service</td>
<td>Woman</td>
<td>🧱 + 🍳 + [U+1F469] + [U+1F373]</td>
</tr>
<tr>
<td></td>
<td>Man</td>
<td>🧱 + 🍳 + [U+1F468] + [U+1F373]</td>
</tr>
<tr>
<td></td>
<td>Chef, cook</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Woman</td>
<td>🧱 + 📔 + [U+1F469] + [U+1F3EB]</td>
</tr>
<tr>
<td></td>
<td>Man</td>
<td>🧱 + 📔 + [U+1F468] + [U+1F3EB]</td>
</tr>
<tr>
<td></td>
<td>Teacher, professor</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>X1F9CD 1F3FD 200D 2640 FE0F 200D X1F9CD 1F3FE 200D 2640 FE0F</td>
<td>STANDING WOMAN, MEDIUM SKIN TONE; ZWJ; STANDING WOMAN, MEDIUM-DARK SKIN TONE.</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>37</td>
<td>X1F9CD 1F3FD 200D 2640 FE0F 200D X1F9CD 1F3FF 200D 2640 FE0F</td>
<td>STANDING WOMAN, MEDIUM SKIN TONE; ZWJ; STANDING WOMAN, DARK SKIN TONE.</td>
</tr>
<tr>
<td>38</td>
<td>X1F9CD 1F3FE 200D 2640 FE0F 200D X1F9CD 1F3FE 200D 2640 FE0F</td>
<td>STANDING WOMAN, MEDIUM-DARK SKIN TONE; ZWJ; STANDING WOMAN, MEDIUM-DARK SKIN TONE.</td>
</tr>
<tr>
<td>39</td>
<td>X1F9CD 1F3FE 200D 2640 FE0F</td>
<td>STANDING WOMAN, MEDIUM-DARK SKIN TONE; ZWJ; STANDING WOMAN, MEDIUM-DARK SKIN TONE.</td>
</tr>
</tbody>
</table>
Gender Inclusivity
Child?
Meet the designer behind gender-neutral emoji

Paul D. Hunt pushed the Unicode Consortium away from stereotypical gender iconography.

By Tanya Basu  August 23, 2022
Child
Adult
Older Adult
Mx. Claus
Apple riles online critics with pregnant man, other progressive emojis

By Ben Cost
January 28, 2022 | 12:49pm | Updated

Apple's new iOS 15.4 will include a pregnant man, nonbinary person with a crown and other inclusive symbols.

Emojipedia
Emoji Stats

Emoji Frequency

<table>
<thead>
<tr>
<th>RANK CHANGE FROM 2019-2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>😊 face with tears of joy</td>
</tr>
<tr>
<td>❤️ red heart</td>
</tr>
<tr>
<td>😂 rolling on the floor laughing</td>
</tr>
<tr>
<td>🌟 thumbs up</td>
</tr>
<tr>
<td>😭 loudly crying face</td>
</tr>
<tr>
<td>🙏 folded hands</td>
</tr>
<tr>
<td>😘 face blowing a kiss</td>
</tr>
<tr>
<td>😍 smiling face with hearts</td>
</tr>
<tr>
<td>😍 smiling face with heart-eyes</td>
</tr>
<tr>
<td>😍 smiling face with smiling eyes</td>
</tr>
<tr>
<td>🎉 party popper</td>
</tr>
<tr>
<td>😍 beaming face with smiling eyes</td>
</tr>
<tr>
<td>💔 two hearts</td>
</tr>
<tr>
<td>🙏 pleading face</td>
</tr>
<tr>
<td>😃 grinning face with sweat</td>
</tr>
<tr>
<td>🔥 fire</td>
</tr>
<tr>
<td>😊 smiling face</td>
</tr>
<tr>
<td>😬 person facepalming</td>
</tr>
<tr>
<td>❤️ heart suit</td>
</tr>
</tbody>
</table>
2022 Emoji Proposals

- Smileys & Emotion: 19.2%
- Activities: 6.1%
- Symbols: 5.4%
- People & Body: 8.8%
- Travel & Places: 10.2%
- Objects: 13.9%
- Food & Beverage: 19.5%
- Animals & Nature: 17.0%
1 Introduction

Emoji are pictographs (pictorial symbols) that are typically presented in a colorful cartoon form and used inline in text. [...] In Unicode 8.0, there is a total of 1,282 emoji, which are represented using 1,051 code points.¹

Recently, there has been considerable interest in adding newly created pictorial symbols, not found in any existing character set, to the Unicode Standard as emoji.² Advocacy groups and others request these code points because Unicode plain text remains the dominant interoperable interchange format for messaging. In practice, before a new emoji can be used, a code point must be assigned and be recognized by the sender and receiver. The stated longer-term goal for Unicode is that implementations should support “embedded graphics, in addition to the emoji characters”.³

In this proposal, we describe a mechanism to uniquely identify arbitrary images within a plain-text Unicode character sequence. This will allow implementers to create their own emoji without needing to request and wait for the assignment of a code point. The basic idea is to encode a globally-unique secure hash of the emoji in a Unicode character sequence. Once the receiver knows the image’s hash, it may already have the corresponding image, or may have a choice of several mechanisms to retrieve it.

² E.g., Taco Emoji campaign, Beard Emoji campaign, Dumpling Emoji campaign. There are currently 79 candidate emoji that have been assigned tentative code points.
Re: QID Emoji Proposal

From: Mark Davis

Date: 2019-01-25, last revised 2019-03-28

For many reasons, the introduction of emoji characters has been beneficial to Unicode and the languages that it serves. For example, because emoji support requires more complex features and supplementary code points, emoji implementations have also helped improve support of complex scripts used by billions of people around the world.

But the standard emoji characters are a closed set. Suppose that someone wants a White-crested tiger heron emoji or a Raclette emoji. Right now they go through a process of writing a proposal for a new character, and providing evidence of expected usage and other criteria. Because Unicode is limited to a relatively small number of new emoji per year, we normally require the expected usage to be above median (ie, roughly the frequency of the hamburger or of the Swiss flag).

While it is possible for a platform to support ZWJ sequences that are valid (but not RGI), the same is not true of single characters. A platform can use private-use characters (there are well over 100,000 Unicode private-use (PU) characters available) but those have major problems:

A. Collisions: there isn’t anything to prevent two different platforms from using the same PU
What’s Coming 2022?
<table>
<thead>
<tr>
<th>№</th>
<th>IMAGE</th>
<th>CLDR SHORT NAME</th>
<th>CLDR KEYWORDS</th>
<th>Proposal</th>
<th>Additional Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1" alt="Light Blue Heart" /></td>
<td>LIGHT BLUE HEART</td>
<td>Cyan, teal, light blue, heart</td>
<td>L2/21-202</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td><img src="image2" alt="Gray Heart" /></td>
<td>GRAY HEART</td>
<td>Gray, silver, slate, heart</td>
<td>L2/21-201</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td><img src="image3" alt="Pink Heart" /></td>
<td>PINK HEART</td>
<td>Pink, like, cute, love, heart</td>
<td>L2/21-203</td>
<td>0</td>
</tr>
<tr>
<td>Nº</td>
<td>IMAGE</td>
<td>CLDR SHORT NAME</td>
<td>CLDR KEYWORDS</td>
<td>Proposal</td>
<td>Additional Score</td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>----------------</td>
<td>----------------------------------------------------</td>
<td>------------</td>
<td>------------------</td>
</tr>
<tr>
<td>11</td>
<td><img src="image1.png" alt="Wing" /></td>
<td>WING</td>
<td>flying, angelic, aviation, bird, mythology</td>
<td>L2/21-198</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td><img src="image2.png" alt="Black Bird" /></td>
<td>BLACK BIRD</td>
<td>bird, crow, raven, black</td>
<td>L2/19-307</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td><img src="image3.png" alt="Goose" /></td>
<td>GOOSE</td>
<td>bird, honk, fowl, silly</td>
<td>L2/21-219</td>
<td>0</td>
</tr>
<tr>
<td>Nº</td>
<td>IMAGE</td>
<td>CLDR SHORT NAME</td>
<td>CLDR KEYWORDS</td>
<td>Proposal</td>
<td>Additional</td>
</tr>
<tr>
<td>----</td>
<td>----------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>9</td>
<td>HYACINTH</td>
<td>flower, nowruz, haftsin, haftseen, purple, lavender, bluebonnet, lupine, snapdragon</td>
<td>L2/21-215</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>JELLYFISH</td>
<td>marine, invertebrate, jelly, stinger, burn, ouch</td>
<td>L2/21-217</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Image</td>
<td>CLDR Short Name</td>
<td>CLDR Keywords</td>
<td>Proposal</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>----------------</td>
<td>--------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td><img src="image" alt="Moose Face" /></td>
<td>MOOSE FACE</td>
<td>antlers, mammal, animal, elk</td>
<td>L2/21-197</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td><img src="image" alt="Donkey" /></td>
<td>DONKEY</td>
<td>mule, burro, stubborn, mammal, animal</td>
<td>L2/21-196</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Image Icon</td>
<td>CLDR Short Name</td>
<td>CLDR Keywords</td>
<td>Proposal</td>
<td>Additional Score</td>
</tr>
<tr>
<td>----</td>
<td>------------</td>
<td>----------------</td>
<td>---------------</td>
<td>-----------</td>
<td>------------------</td>
</tr>
<tr>
<td>7</td>
<td><img src="image1.png" alt="ginger" /></td>
<td>GINGER</td>
<td>spice, root, beer,</td>
<td><strong>L2/21-200</strong></td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td><img src="image2.png" alt="pea pod" /></td>
<td>PEA POD</td>
<td>edamame, pod, beans, vegetable, legume, pea</td>
<td><strong>L2/21-199</strong></td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>IMAGE</td>
<td>CLDR SHORT NAME</td>
<td>CLDR KEYWORDS</td>
<td>Proposal</td>
<td>Additional Sequence</td>
</tr>
<tr>
<td>----</td>
<td>--------</td>
<td>----------------</td>
<td>-----------------------------</td>
<td>----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>20</td>
<td><img src="image" alt="Wireless Icon" /></td>
<td>WIRELESS</td>
<td>internet, computer, network</td>
<td>L2/21-191</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td><img src="image" alt="Khanda Icon" /></td>
<td>KHANDA</td>
<td>Sikh, religion</td>
<td>L2/21-223</td>
<td>0</td>
</tr>
</tbody>
</table>

**religion**
<table>
<thead>
<tr>
<th>No</th>
<th>Image</th>
<th>CLDR Short Name</th>
<th>CLDR Keywords</th>
<th>Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td><img src="image" alt="Shaking Face" /></td>
<td>SHAKING FACE</td>
<td>Shock, shaking, face, earthquake, vibrate,</td>
<td>L2/21-214</td>
</tr>
<tr>
<td>Nº</td>
<td>IMAGE</td>
<td>CLDR SHORT NAME</td>
<td>CLDR KEYWORDS</td>
<td>Proposal</td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>18</td>
<td><img src="image1.png" alt="Image" /></td>
<td>FOLDING HAND FAN</td>
<td>fan, cooling, hot, heat, shy, coy, spread, flutter, dance</td>
<td>L2/21-192</td>
</tr>
<tr>
<td>19</td>
<td><img src="image2.png" alt="Image" /></td>
<td>HAIR PICK</td>
<td>Afro, hair, pick, comb</td>
<td>L2/21-218</td>
</tr>
<tr>
<td>No.</td>
<td>Image</td>
<td>CLDR Short Name</td>
<td>CLDR Keywords</td>
<td>Proposal</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>----------------</td>
<td>---------------</td>
<td>------------</td>
</tr>
<tr>
<td>16</td>
<td><img src="image.png" alt="Maracas" /></td>
<td>MARACAS</td>
<td>music, noise, celebrate, shake, instrument, rattle, rhythm, percussion</td>
<td>L2/21-194</td>
</tr>
<tr>
<td>17</td>
<td><img src="image.png" alt="Flute" /></td>
<td>FLUTE</td>
<td>toot, flautist, recorder, music, woodwind, bamboo, pipe, fife</td>
<td>L2/21-193</td>
</tr>
</tbody>
</table>
Beyond 2022
RIP Family Emoji
Fig 4. Family Emoji today (left), Family Emoji moving forward (right)
Exploring Emoji Directionality

Author: Sean Stewart and Jennifer Daniel on behalf of the Emoji Subcommittee (ESC)
Date: Oct 19, 2022

Introduction

As the ESC reviews requests from the public for new emoji, we encounter increasing evidence that the existing corpus of emoji is hitting or is rapidly about to hit thresholds of saturation. In order for emoji to operate at the speed of language online, the ESC’s time and energy has turned towards looking at the emoji experience more holistically—that is, to see which improvements can be made to the existing repertoire of emoji—to address fundamental needs.

While there are no plans to stop adding new emoji characters, an incredibly powerful aspect of written language is that it consists of a finite number of characters that can "do it all". In this spirit, we are here to challenge a presumption that the primary way for emoji to move forward is to add more of them to the Unicode Standard. As the ESC actively explores viable paths forward, one track has demonstrated great potential and promises exciting possibilities.
Why does emoji direction matter?
Because not all languages run in the same direction.
Arabic.
Right to Left
Left to Right
Right to Left
Left to Right
# Left-to-Right vs. Right-to-Left

## Example of Semantic Changes

<table>
<thead>
<tr>
<th>Directionality</th>
<th>Sequence</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTR</td>
<td>🏃️💨⚠️🚗🚗🚗</td>
<td>Quickly running away from a line of cars</td>
</tr>
<tr>
<td>RTL</td>
<td>🚗🚗⚠️💨🏃🏼</td>
<td>Warning to not run behind car fumes</td>
</tr>
</tbody>
</table>
Inline Sticker Support
5. Inline Emotes / Stickers Support

At this time we have no update since the Q3 UTC meeting on the subject of Inline Emotes (L2/22-180). Vendors continue to investigate which of the presented directions (if any) continue to make sense in today’s market. Internet communication media continue to improve support for the sharing of customized, arbitrary, emoji-like images in-line with text, and platform vendors continue to show interest in improving this functionality to be platform-independent.
This was CS50