CIS 371 Web Application Programming

Vue3 I

Fundamentals with the Composition API

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Based on the original version by Professor Hans Dulimarta.

What is Vue?

- Vue (pronounced /vjuː/, like view) is a JavaScript framework for building user interfaces. It builds on top of standard HTML, CSS, and JavaScript and provides a declarative and component-based programming model that helps you efficiently develop user interfaces, be they simple or complex.

History of Vue.js

- Created by Evan You (ex-Googler)
- Version 0.6: Dec 2013 (first version on GitHub)
- Oct 2015: version 1.0
- 2016-2018: vers 2.0-2.5
- 2019-2021: vers 2.6.0-2.6.14
- 2020-2022: version 3.0-3.2
- Latest version: 3.2.31

Related Background:

Custom (HTML) Elements/ W3C Web Components

Why Web Components?

Native HTML

```
<head>
  <style>
    .fancy-button {
      background-color: #6200ea;
      color: white;
      padding: 10px 20px;
      border: none;
      border-radius: 5px;
      cursor: pointer;
    }

    .fancy-button:hover {
      background-color: #3700b3;
    }
  </style>
</head>
<body>
  <button class="fancy-button">Click Me</button>
  <button class="fancy-button">Submit</button>
  <script>
    document.querySelectorAll('.fancy-button').forEach(button => {
      button.addEventListener('click', () => {
        alert('Button clicked!');
      });
    });
  </script>
</body>
```

With Web Components

```
<head>
  <title>Web Components Button Example</title>
  <script src="fancy-button.js" defer></script>
</head>
<body>
  <h2>Web Components</h2>
  <fancy-button label="Click Me"></fancy-button>
  <fancy-button label="Submit"></fancy-button>
</body>
```

- The logic for the Web Component is in a separate file, making it reusable across different HTML pages.

- The HTML file focuses on the structure and layout, while the JavaScript file handles the Web Component's behavior and styling.

Resources

https://vuejs.org/guide (v1, v2, v3)
https://www.vuemastery.com

Which Vue version?

- Vue 2.6.x
  - Many options for UI third-party libraries
  - These UI libraries are being ported to support Vue 3.x
- New features in Vue 3.x
  - Separate configuration settings per instance: easier to create multiple instances of VueJS within one web app
  - Composition API
    - Easier to maintain large components
    - Easier to maintain shared logic across multiple components
  - Reactive references

Options API vs. Composition API

Vue 3 Composition API

```
<script setup>
import { ref, onMounted } from 'vue';

const task = ref("Complete the Vue.js project"); // Reactive state for the task
const logTask = () => console.log(`Your current task is: ${task.value}`);

onMounted(() => {
  logTask();
});
</script>
```

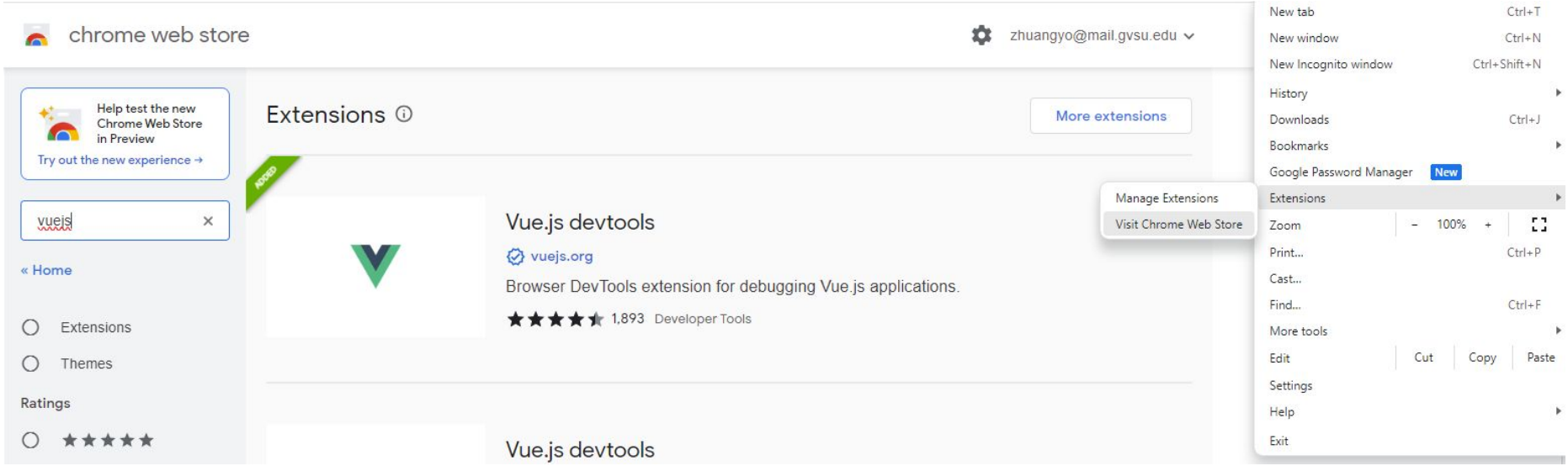
Vue 2 Options API

```
<script>
export default {
  data() {
    return {
      task: "complete the Vue.js project",
    };
  },
  methods: {
    logTask() {
      console.log(`Your current task is: ${this.task}`);
    },
  },
  mounted() {
    this.logTask();
  },
};
</script>
```

Vue Single File Component Playground

https://sfc.vuejs.org/

Vue DevTools



Create a new Vue App Using vite 4.x

- Install Node.js
  - Using Docker
  - Direct Installation Node.js
- Install yarn (Optional)

```
npm --version                                          // check your NPM version

# Option 1
npm create vite@latest my-app --template vue-ts       // NPM 6.x
npm create vite@latest my-app -- --template vue-ts    // NPM 7.x or later

# Option 2
yarn create vite my-app --template vue-ts
```

Run Vue App

package.json

```
"scripts": {
  "dev": "vite",
  "build": "vue-tsc && vite build",
  "preview": "vite preview"
},
"dependencies": {
  "vue": "^3.3.4"
},
"devDependencies": {
  "@vitejs/plugin-vue": "^4.2.3",
  "typescript": "^5.0.2",
  "vite": "^4.4.5",
  "vue-tsc": "^1.8.5"
}
```

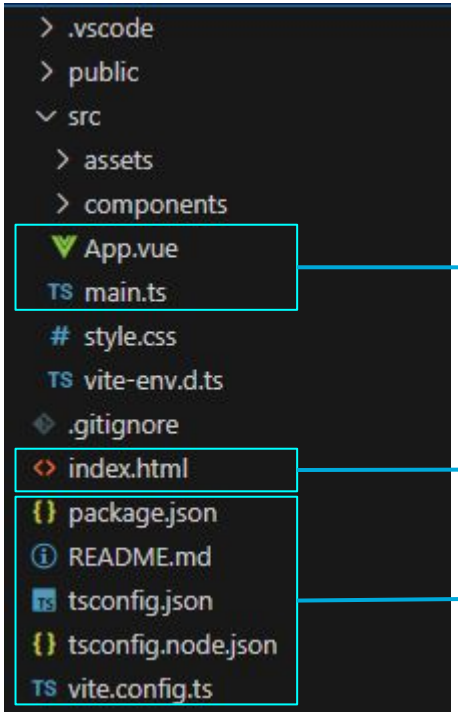
```
npm install

npm run dev
# OR
yarn dev

npm run build
# OR
yarn build

npm run preview
# OR
yarn preview
```

Files Generated by vite



Main entry point and Vue components

Webapp landing page

Project settings

Anatomy of a .vue (SFC = Single File Component)

.vue = .html + (.ts|.js) + (.css|.scss|.sass)

src/SampleComponent.vue

```
<template>
  <div>My number is {{ count }}</div>
</template>

<script setup lang="ts">
import { ref } from "vue";
const count = ref(73);
</script>

<style scoped>
/* CSS style rules applied to the HTML template above */
</style>
```

Hello World Project (default)

public/index.html

```
<body>
  <div id="app"></div>
  <!-- built files will be auto injected -->
</body>
```

src/main.ts

```
import { createApp }
import './style.css'
import App from './App.vue'

createApp(App).mount('#app')
```

src//App.vue

```
<template>
  <div>
    <a href="https://vitejs.dev" target="_blank">
      <img src="/vite.svg" class="logo" alt="Vite logo" />
    </a>
    <a href="https://vuejs.org/" target="_blank">
      <img src="./assets/vue.svg" class="logo vue" alt="Vue logo" />
    </a>
  </div>
  <HelloWorld msg="Vite + Vue" />
</template>
```

Typical project organization:

- *One index.html*
- *One main.ts*
- *Many xxxx.vue files*

Anatomy of a .vue (SFC = Single File Component)

src/SampleComponent.vue

```
<template>
  <!-- The UI design in HTML goes here -->
</template>

<script setup lang="ts">
import { ref } from 'vue'

// Your data and methods/functions
</script>

<style scoped>
/* CSS style rules applied to HTML template above. */
</style>
```

<template> contains the HTML elements

The script includes the data and logical code for this component.

"scope" attribute implies the style will be applied only to this component and NOT to the child components of this one

HTML Attributes for Data Binding Directives

- v-bind: bind Vue data to HTML (native) attribute
- v-for: repeat data from arrays/lists
- v-if, v-else, v-else-if, v-show: conditional rendering
- v-model: 2-way data binding (data ⇌ UI)
  - Compare it to 1-way binding {{my_data}}
- And many more: v-text, v-html, ...

1-way Data Binding
From variables to UI

v-bind: bind (Vue) data to HTML attributes

src/Hello.vue

```
<template>
  <div>
    <img src="https://avatars.githubusercontent.com/u/6128107?s=280&v=4" />
    <img v-bind:src="imgLocation" />
    <img :src="imgLocation" />
  </div>
</template>
<script setup lang="ts">
import { ref } from 'vue'
const imgLocation = ref("https://avatars.githubusercontent.com/u/6128107?s=280&v=4");
</script>
```

```
// Compare to the following code snippet
const imgLocation = "https://bit.ly/10923f8d998.png";
const imgEl = document.createElement("img");
imgEl.setAttribute(src, imgLocation);
```

double moustache syntax: {{data}}
binds data/var to text nodes

v-bind:attr=”data” binds data/var to HTML attrs

1-way Data Binding

```vue
<template>
    <h1>Hello {{ who }}</h1>
</template>

<script setup lang="ts">
import { ref } from 'vue';

const who = ref("VueJS 3.x");
</script>

<style scoped>
h1 {
  color: #888;
}
</style>
```

```
<h1>Hello {{ who.toLocaleUpperCase() }}</h1>
```

Only evaluate one expression at a time

```
<h1>Hello {{ who.toLocaleUpperCase(); who = "World" }}</h1>
```

1-way Data Binding

```
<template>
    <h1>Hello {{ who }}</h1>
  </template>

  <script setup lang="ts">
  import { ref } from 'vue';

  const who = ref("VueJS 3.x");
  </script>

  <style scoped>
  h1 {
    color: #888;
  }
  </style>
```

```
<h1>Hello {{ if(!who) {return "World"} }}</h1>
```

```
<h1>Hello {{ who? who: "World" }}</h1>
```

```
<h1>Hello {{ who || "World" }}</h1>
```

Iterate over arrays: v-for

src/Hello.vue

```
<template>
  <h1>Chemical Elements</h1>
  <ol>
    <li v-for="(a, idx) in atoms" v-bind:key="idx">{{ a }}</li>
// or  <li v-for="(a, idx) in atoms" :key="idx">{{ a }}</li>
  </ol>
</template>
<script setup lang="ts">
import { ref } from 'vue'
const atoms = ref(["Argon", "Barium", "Carbon"]);
</script>
```

```
<ol>
  <li>Argon</li>
  <li>Barium</li>
  <li>Carbon</li>
</ol>
```

Chemical Elements

1. Argon
2. Barium
3. Carbon

Rendered Output

- *v-for must be used together with :key*
- *:key is required for improved VueJS rendering performance*
- *:key must be a unique value (of any data type) among siblings*

More on v-for :key

```
<ul>
  <li v-for="(a, idx) in atoms" :key="idx">{{ a.name }}</li>
</ul>
```

```
<script setup lang="ts">
import { ref } from 'vue';
const atoms = ref([
  { symbol: "Ar", name: "Argon" },
  { symbol: "C", name: "Barium" },
  { symbol: "Ne", name: "Carbon" }
]);
</script>
```

*Keys must be **unique among siblings** (like **primary keys** in DB)*

```
<ul>
  <li v-for="a in atoms" :key="a.symbol">{{ a.name }}</li>
</ul>
```

Using key with v-for in Vue.js 3

- Include key:
  - Whenever you've got something unique
  - You're iterating over more than a simple hard coded array
  - and even when there is nothing unique but it's dynamic data (in which case you need to generate random unique id's)
- Without key:
  - You have nothing unique AND
    - When you're quickly testing something or demonstrating basic functionality with v-for
    - If you’re iterating over a simple hard-coded array that doesn't change and doesn’t need complex updates (not dynamic data from a database, etc)

Repeating a group of elements (the wrong way)

src/Movie.vue

```vue
<template>
  <div>
    <h2 v-for="(movie, idx) in movies" :key="idx">{{ movie.title }}</h2>
    <p v-for="(movie, idx) in movies" :key="idx">Release year: {{ movie.year }}</p>
  </div>
</template>
<script setup lang="ts">
import { ref } from 'vue';
const movies = ref([
  { title: "Batman Begins", year: 2005 },
  { title: "The Upside", year: 2017 },
]);
</script>
```

```html
<div>
  <h2>Batman Begins</h2>
  <h2>The Upside</h2>
  <p>Release year: 2005</p>
  <p>Release year: 2017</p>
</div>
```

Rendered Output

Batman Begins
The Upside
Release year: 2005
Release year: 2017

We need to put the title and year of each movie in a block.

Repeating a group of elements

```vue
<template>
  <div v-for="(movie, idx) in movies" :key="idx">
    <h2>{{ movie.title }}</h2>
    <p>Release year: {{ movie.year }}</p>
  </div>
</template>
<script setup lang="ts">
import { ref } from 'vue';

const movies = ref([
  { title: "Batman Begins", year: 2005 },
  { title: "The Upside", year: 2017 },
]);
</script>
```

src/Movie.vue

```html
<div>
  <h2>Batman Begins</h2>
  <p>Release yer: 2005</p>
</div>
<div>
  <h2>The Upside</h2>
  <p>Release yer: 2017</p>
</div>
```

Batman Begins
Release year: 2005

The Upside
Release year: 2017

Rendered Output

Repeat N times: v-for

src/Hello.vue

```
<template>
  <div>
    <h1>Count Down</h1>
    <p v-for="n in 5" v-bind:key="n">Downto {{ 6 - n }}...</p>
  </div>
</template>
```

- *The loop variable (n in the above snippet) starts at **ONE** (not zero)*
- *Variables can be used in place of the constant (number 5)*

Count Down

Downto 5…
Downto 4…
Downto 3…
Downto 2…
Downto 1...

Rendered Output

Conditional: v-if, v-else-if, v-else

src/Random.vue

```vue
<template>
  <div>
    <h2>Random number: {{ randVal }}</h2>
    <p v-if="randVal < 31">Below 31</p>
    <p v-else-if="randVal > 87">87 or more</p>
    <p v-else>Between 32-87</p>
  </div>
</template>
<script setup lang="ts">
import { ref } from "vue";
const randVal = ref(Math.floor(Math.random() * 100));
</script>
```

These directives automatically suppress elements whose condition evaluates to FALSE

Random number: 49

Between 32-87

Rendered Output

```vue
<div>
  <h2>Random number: 49</h2>
  <p>Between 32-87</p>
</div>
```

```vue
<div>
  <h2>Random number: 14</h2>
  <p>Below 31</p>
</div>
```

Random number: 14

Below 31

Rendered Output

Group Conditional

Poor

```
<template>
  <div>
    <h2>Introduction</h2>
    <p>Lorem ipsum ...blah...blah...</p>
    <h2 v-if="!loggedIn">Logging in to your Account</h2>
    <p v-if="!loggedIn">Please do the following___</p>

    <p>Thank you!</p>
  </div>
</template>
```

Better

```
<template>
  <div>
    <h2>Introduction</h2>
    <p>Lorem ipsum ...blah...blah...</p>
    <template v-if="!loggedIn">
      <h2>Logging in to your Account</h2>
      <p>Please do the following___</p>
    </template>
    <p>Thank you!</p>
  </div>
</template>
```

v-if vs. v-show

src/Sample.vue

```
<template>
  <div>
    <p>Welcome</p>
    <p v-if="debugMode">Use STOP to kill the app</p>
    <p>Good Bye!</p>
  </div>
</template>
<script setup lang="ts">
import { ref } from "vue";
const debugMode = ref(false);
</script>
```

src/Sample.vue

```
<template>
  <div>
    <p>Welcome</p>
    <p v-show="debugMode">Use STOP to kill the app</p>
    <p>Good Bye!</p>
  </div>
</template>
<script setup lang="ts">
import { ref } from "vue";
const debugMode = ref(false);
</script>
```

```
<div>
  <p>Welcome</p>
  <p>Good bye!</p>
  <p></p>
</div>
```

```
<div>
  <p>Welcome</p>
  <p style="visibility: none">Use STOP to kill the app</p>
  <p>Good bye!</p>
  <p></p>
</div>
```

v-show and v-if on Custom Vue Elements

```vue
<template>
  <DeliveryMessage order-id="FY4328ZX" v-if="itemDelivered"></DeliveryMessage>
</template>

<script setup lang="ts">
import { ref } from 'vue'

const itemDelivered = ref(false)
</script>
```

Since DeliveryMessage is NOT rendered, any initialization logic in DeliveryMessage.vue did NOT run

```vue
<template>
  <DeliveryMessage order-id="FY4328ZX" v-show="itemDelivered"></DeliveryMessage>
</template>

<script setup lang="ts">
import { ref } from "vue";

const itemDelivered = ref(false);
</script>
```

Since DeliveryMessage is rendered (but hidden), any initialization logic in DeliveryMessage.vue would have RUN

1-way Data Binding (from variables to UI)

```
<template>
  <h1>Hello {{ who }}</h1>
  <div>
    <img :src="imgLocation" />>
    <ol>
      <li v-for="(a, idx) in atoms" v-bind:key="idx">{{ a }}</li>
    </ol>
  </div>
  <h2>Random number: {{ randVal }}</h2>
  <p v-if="randVal < 31">Below 31</p>
  <p v-else-if="randVal > 87">87 or more</p>
  <p v-else>Between 32-87</p>
</template>
<script setup lang="ts">
import { ref } from "vue";
const who = ref("VueJS 3.x");
const imgLocation = ref("https://bit.ly/10923f8d998.png");
const atoms = ref(["Argon", "Barium", "Carbon"]);
const randVal = ref(Math.random() * 100);
</script>
```

Demo

Practice