



INFS3202/7202 – Web Information Systems

Lecture Week 13: NoSQL Databases and Exam Revision

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Course Updates

Issue/Feedback	Change
SECaTS Open	<ul style="list-style-type: none">• Please provide feedback on INFS3202/7202
Project Assessment Item	<ul style="list-style-type: none">• Grading is underway• Grades will be released on Mon 3 Jun
Exam Required a Student ID Card	<ul style="list-style-type: none">• Please apply for a Student Card if you don't have one• Exam is Identity Verified

Relational vs NoSQL Databases

Relational Databases

- **Structured Data:**
Relational databases use SQL for defining and manipulating data.
- **Table-based:**
Data is stored in tables consisting of rows and columns.
- **Relational:**
SQL databases use relationships (foreign keys) to connect data across tables.
- **ACID Compliance:**
SQL databases follow the ACID (Atomicity, Consistency, Isolation, Durability) properties for transaction management.

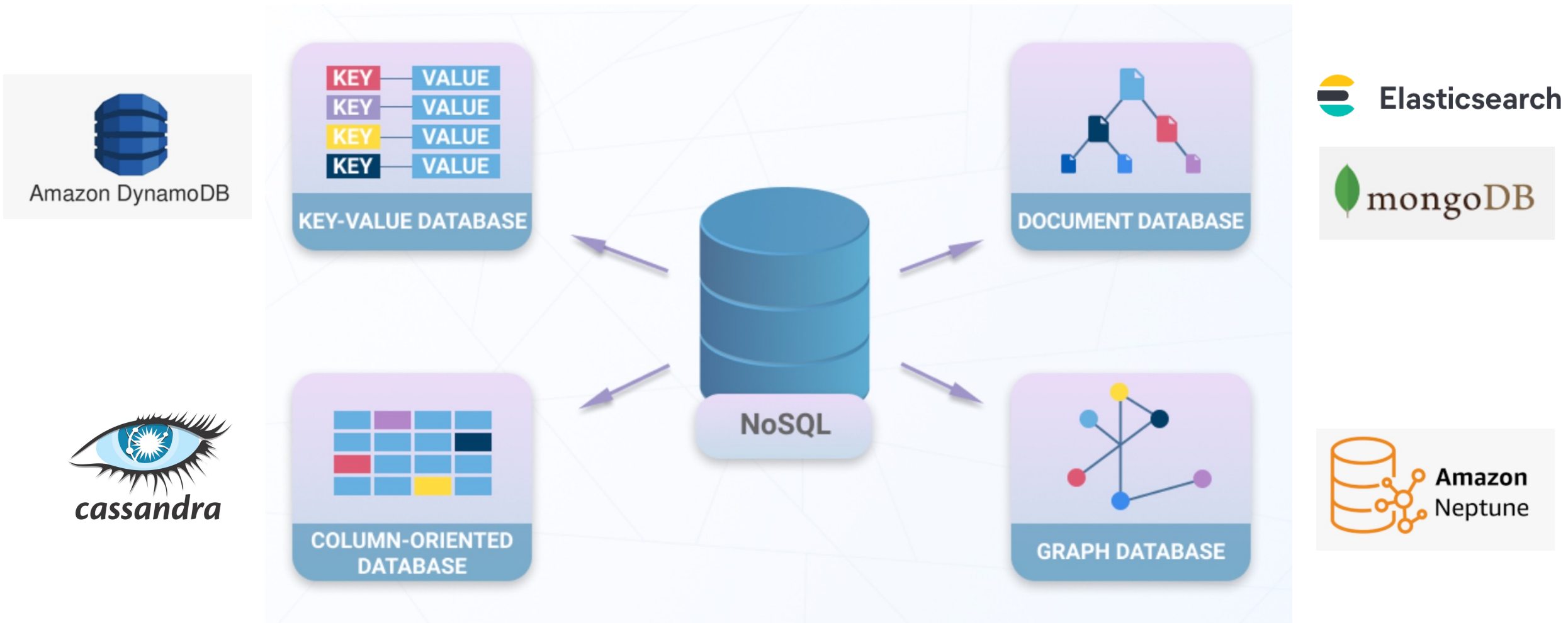
Common Relational Databases



NoSQL Databases

- **Schema-less:**
No predefined schema, allowing for flexible data models.
- **Distributed Architecture:**
Designed for horizontal scaling and distributed data storage.
- **Variety of Data Models:**
Supports multiple data models, including document, key-value, column-family, and graph.
- **Eventual Consistency:**
Some NoSQL databases prioritize availability over immediate consistency i.e. Basically Available, Soft state, Eventual consistency (BASE).
- **Designed for Big Data:**
Handles large volumes of unstructured or semi-structured data.

Types of NoSQL Databases



<https://blog.devart.com/sql-vs-nosql.html>

NoSQL Databases

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Supports multiple data models, including document, key-value, column-family, and graph.
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- **Designed for Big Data:**
Handles large volumes of unstructured or semi-structured data.
Ideal for large sets of distributed data that needing scalability.

Beware of Eventual Consistency

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by  Abel Avram

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The recent theft from several BitCoin operators has sparked a debate whether eventually consistent databases are useful or not for banking.

On March 2, 2014 [Flexcoin lost all its bitcoins](#) due to a code flaw. The attacker issued thousands of concurrent requests ordering transfers from one of his accounts to another. He then repeated the operation with other accounts until all bitcoins were withdrawn. This was possible because the code was not written to deal with multiple concurrent requests, and all the transfers happened before the balances were updated. If a balance is not updated in time, a new request could be granted even if the account normally is empty. As a result, Flexcoin shut down operations after losing 896 BTC valued at about half a million dollars.


[The same happened with Poloniex two days later](#), but they lost only 12.3% of their bitcoins and the company covered the losses, managing to stay afloat.

[Emin Gün Sirer](#), an Associate Professor at [Cornell University](#), wrote a [blog post blaming eventually consistent data stores for the lost bitcoins](#). He mentions MongoDB, Cassandra and Riak among the NoSQL solutions that

RELATED CONTENT


Eventual Consistency – Don't Be Afraid!

DEC 20, 2023




Managing 238M Memberships at Netflix

MAR 25, 2024




Banking on Thousands of Microservices

JAN 04, 2024




Streaming Databases: Embracing the Convergence of Stream Processing and Databases

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Slack Optimizes Internal Development and Cost Efficiency with EKS and Karpenter

MAY 17, 2024



<https://www.infoq.com/news/2014/04/bitcoin-banking-mongodb/>

10

NoSQL Databases have both powerful and challenging query languages

```
POST my-index/_search
{
  "query": {
    "bool": {
      "must_not": [
        {
          "nested": {
            "path": "comments",
            "query": {
              "term": {
                "comments.author": "nik9000"
              }
            }
          }
        }
      ]
    }
  }
}
```

Console ▾ [Copy as curl](#) [Try in Elastic](#) ⚙

<https://www.elastic.co/guide/en/elasticsearch/reference/current/query-dsl-nested-query.html>

Both MySQL and Postgres Support JSON

- Both MySQL and PostgreSQL offer robust support for JSON data, allowing for flexible and efficient storage, querying, and manipulation of JSON documents.
- MySQL provides a native JSON data type with functions for JSON manipulation and indexing support via generated columns.
- PostgreSQL offers both JSON and JSONB data types, with JSONB providing superior indexing and querying capabilities.
- This allows us to combine relational databases with json (document storage) powerful for handling semi-structured data.

Relational Database – Query Optimization

- **Identify Slow Queries:** Use database performance monitoring tools to identify slow-running queries. Common tools include EXPLAIN (MySQL, PostgreSQL) to analyze query execution plans.
- **Check Existing Indexes:** Review existing indexes to ensure they are being used effectively. Sometimes, an index might be present but not utilized by the query optimizer.
- **Create Indexes on Frequently Queried Columns:** Index columns that are frequently used in WHERE clauses, JOIN conditions, and ORDER BY clauses to speed up query performance.

Course Recap

What have you learned?

Learning Objectives

From Course Profile

1. Apply system architecture principles to design and deploy Web Information Systems (WIS) solutions.
2. Evaluate and articulate the scope, complexity, and key considerations in the design and implementation of Web Information Systems.
3. Design and program Web Information Systems (WIS) with server-side functionalities.
4. Develop responsive Web-based, database-driven applications using efficient and effective technologies.
5. Evaluate and justify the suitability of Web Information Systems solutions in various contexts, considering factors such as user needs and technical constraints.
6. Judge in which situations WIS solutions are more or less appropriate.
7. Critically analyze current issues and emerging trends in Web Information Systems development, and predict potential impacts on future practices and technologies.

Lectures and Practicals – Week 1 to 6

Week	Lecture	Practical
Week 1	Course Overview & Intro to WWW	No Practical in Week 1
Week 2	Creating and Deploying Web Applications (includes HTML, CSS Recap, PHP and basic UI layouts)	Practical 1: UQCloud, HTML and PHP
Week 3	MVC 1 – Controller and View (includes UX prototyping with CSS libraries)	Practical 2: Building your First CodeIgniter Project
Week 4	MVC 2 – Models & SQL Databases (includes database design patterns, SQL)	Practical 3: Databases and Models
Week 5	MVC 3 – Creating CRUD Applications	Practical 4: Designing UI's with CSS Frameworks
Week 6	MVC 4 – Advanced topics (File uploads, caching, sessions, authentication & authorisation)	Practical 5: Search and Form Processing
Mid-Semester Break		



Lectures and Practicals – Week 7 to 13

Week	Lecture	Practical
Week 7	Incorporating GenAI features in Web Applications (Calling GenAI API's, Creating Chatbots and Retrieval Augmented Generation)	Practical 6: Incorporating GenAI
Week 8	Designing RESTFul API's & JavaScript (CodeIgniter RESTful resource handling, API Auth tokens)	Practical 7: Creating RESTFul API's
Week 9	Developing Progressive Web Applications (Responsive CSS, PWA's, Accessibility)	Practical 8: Work on Project
Week 10	Deploying to the Cloud - Guest Lecturer from AWS Solution Architects (VPC, Route66, EC2, Gateway and Load Balancing)	Project Code Review
Week 11	Web Security	Practical 9: Deployment to AWS
Week 12	Other MVC frameworks (Flask, Django, FastAPI, Next.JS) & Guest Lecture – Working as a Web Developer	Practical 10: Work on Project
Week 13	NoSQL Databases & Exam Tips	Practical 11: Exam Revision

By the end of the course you should be able to go from an idea to a web application:

- Design a database
- Design and Implement the UI
- Program the functionality in a server-side programming language
 - Also learned about using client-side code to improve UX
- Deploy the application (in the cloud e.g. AWS)
- Use GenAI Ethically and Creatively
 - We covered both prompting to help you code and including GenAI functionality in your projects

Developer Roadmaps



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Full Stack Developer

Step by step guide to becoming a modern full stack developer in 2024

[← All Roadmaps](#) [Share](#) [Download](#) [Suggest Changes](#)

0% DONE 0 completed · 0 in progress · 0 skipped · 37 Total [Track Progress](#)

 What is Full Stack Development? 

Full Stack

Audience Note

If you are already a full-stack developer you should visit these roadmaps instead.

[Frontend](#) [Backend](#) [DevOps](#)

Target audience for this roadmap is absolute beginners wanting to get into full stack development.

Find the detailed version of this checklist
With details on how to implement these

<https://roadmap.sh>

Project Ideas and Suggestions

Key topics to learn

Change of Domain

HTML CSS JavaScript

<https://roadmap.sh/full-stack>

Exam Tips

Exam Tips

- Covers the concepts of web information systems/web applications
- Combination of multiple choice questions (32) and free text questions (5)
- Weighting 30 marks
- Identity Verified Assessment Hurdle
 - You must get ≥ 15 marks to pass the course
 - You must have your Student ID
- No specific questions on PHP syntax as some students have used other frameworks and also because 'programming' a web application is already accessed by the Project Assessment Item and the Code Review.

What to study?

- Basic Linux commands e.g. ls, cd, mv, cp, nano, sudo, mkdir, chmod
- Basic Nginx config e.g. root and location,
- Definitions and Acronyms e.g. CSS, HTML, HTTP, SSH, HTTP Status codes, etc
- MVC Architecture
- Relational databases, database design and SQL queries
- Forms and how to process the data
- HTML tags e.g. Form, a, img, link, table, p, etc
- How to build a web application given requirements/features?
- All of the topics covered in Lectures and Labs
 - Except Week 7 Gen AI Prompting and AWS Guest Lecture (but some of the AWS Lab definitions are important)

Different Exams for INFS3202 and INFS7202

Final Exam

Type: Exam - during Exam Period (Central)

Learning Objectives Assessed: 1, 2, 3, 4

Due Date: Examination Period

Weight: 30%

Reading: 10 minutes

Duration: 120 minutes

Format: Multiple-choice, Short answer, Problem solving

Task Description:

Compared to INFS3202, more difficult questions will be designed in the final exam of INFS7202. Postgraduates from INFS7202 are expected to have a higher capability in problem-solving and critical thinking.

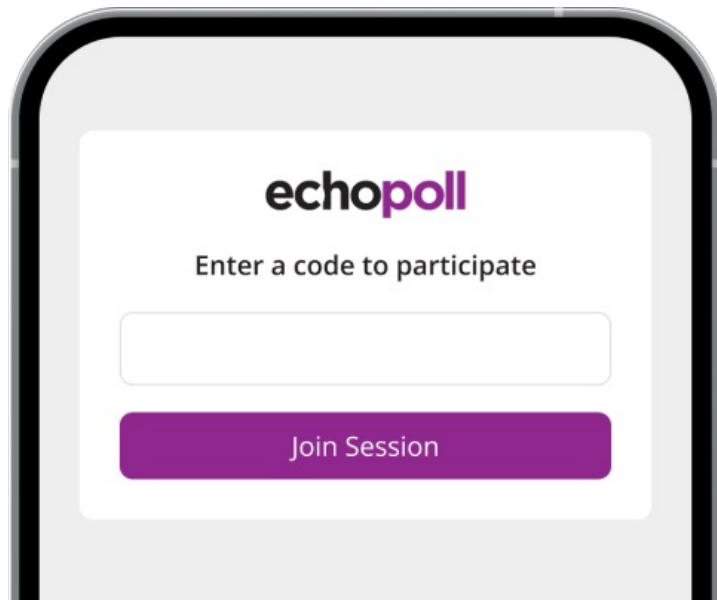
This course will have one final exam. A minimum of 15/30 marks must be obtained in the final exam to pass this course. The final exam is designed to test theoretical concepts and basic programming skills introduced in this course. Exams will address all materials covered by lecture notes.

https://archive.course-profiles.uq.edu.au/student_section_loader/section_5/132735#551847

Quiz

To join the quiz

Go to
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Scan the QR code with
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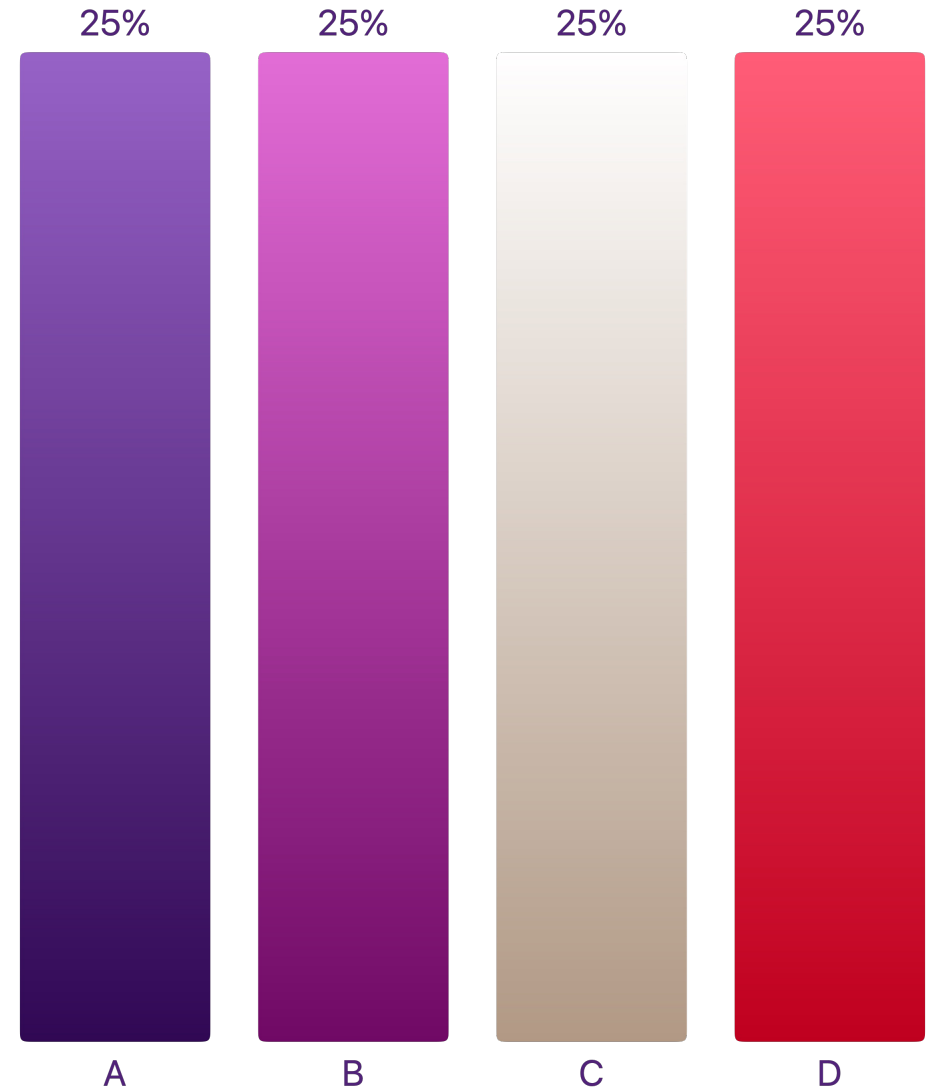
Enter Code

2921892

Only scan if you are at the Live Lecture

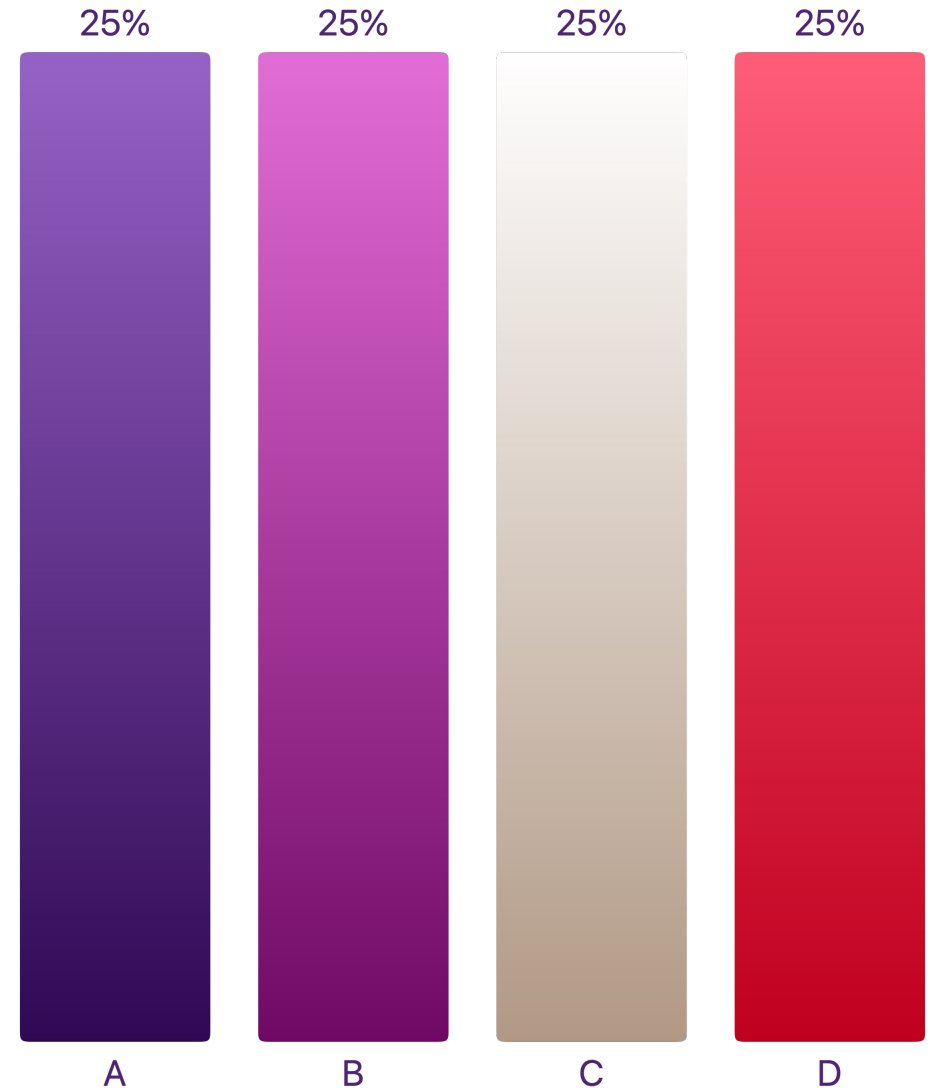
Q1. What does HTML stand for?

- ✓ A. HyperText Markup Language
- B. HighText Machine Language
- C. HyperText and Links Markup
- D. HyperTool Markup Language



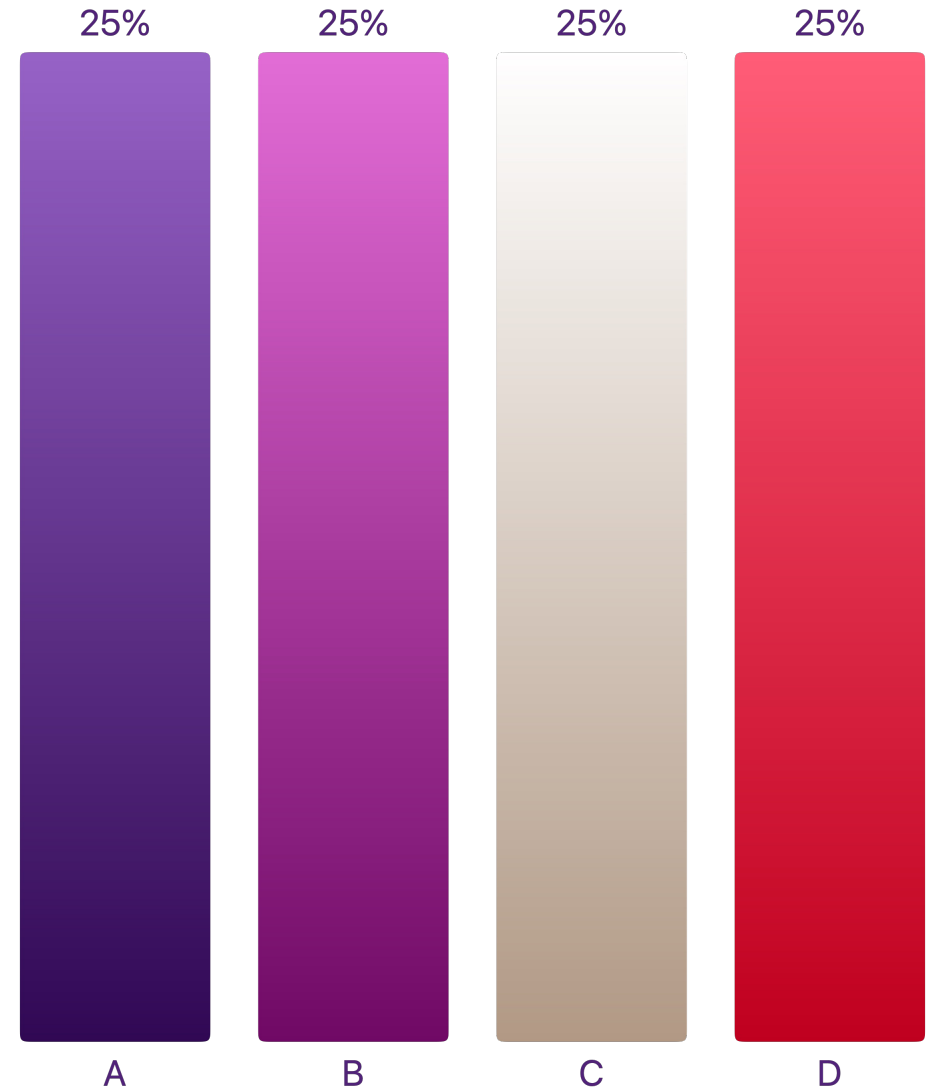
Q2. What is the role of the model in MVC?

- ✓ A. Provides an objected oriented way to save, update and delete database table entries
- B. Gets and processes user input from a view
- C. Renders HTML
- D. Saves files to a folder



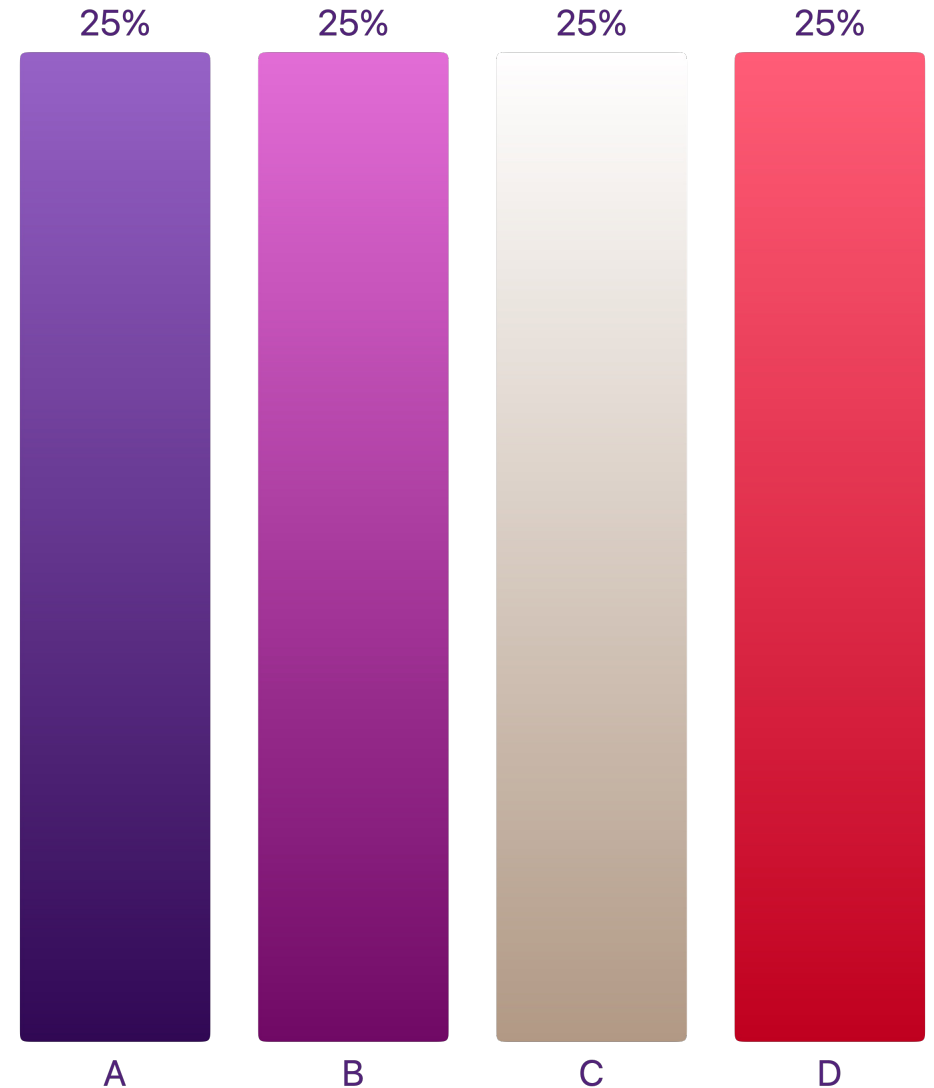
Q3. How can you call a RESTFull API from JS?

- A. You can only call an API from the server
- ✓ B. The FetchAPI allows you to call an API and get the JSON response
- C. Use a HTML Template tag
- D. Client-side and server-side run separately



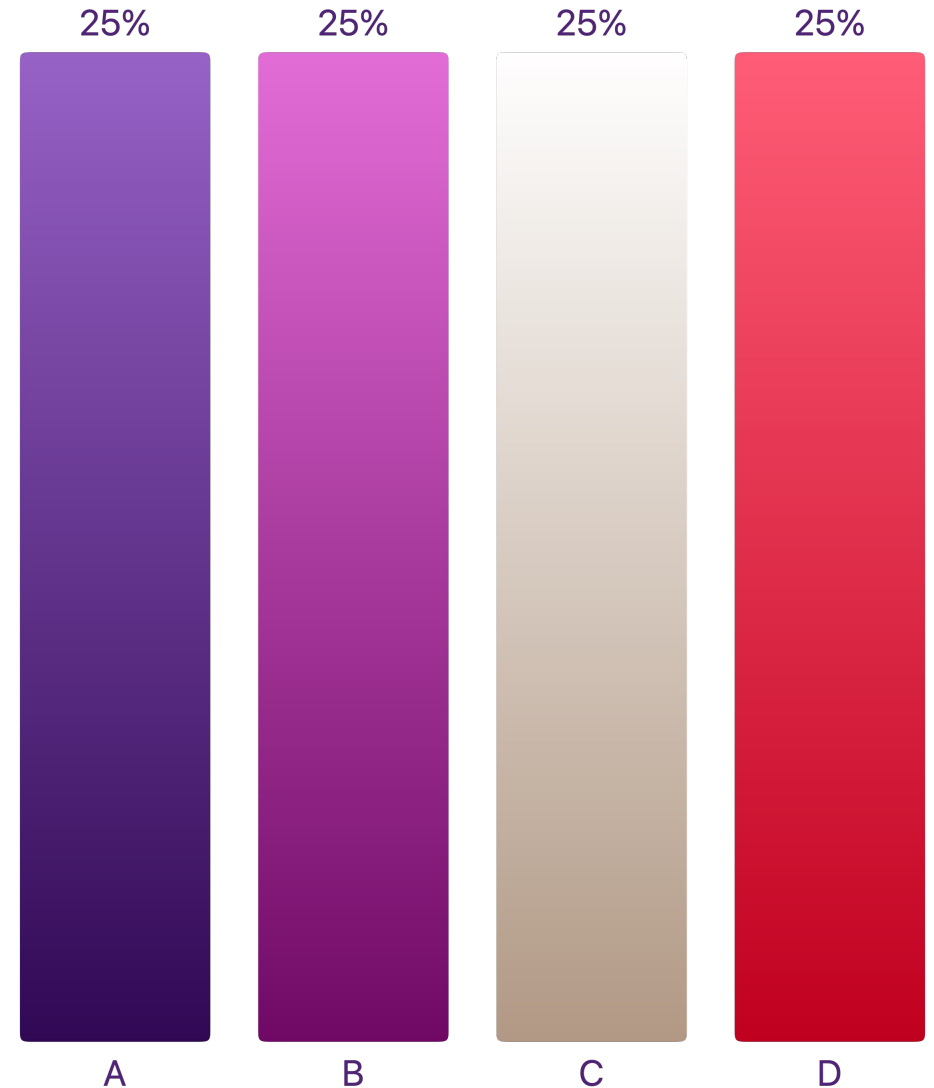
Q4. What does a form tag with method set to 'Get' do?

- A. Nothing the method should be set to 'Post'
- B. Sends the form to URL in the action attribute of the form tag
- ✓ C. Appends the form fields to the URL as a querystring
- D. Posts the form fields to the server for processing



Q5. What attribute in a img tag helps with accessibility?

- A. The alternate attribute is used to describe the image
- B. The description attribute is used to describe the image
- C. Images are visual and no attribute is required
- ✓ D. The alt attribute is used to provide a description of the image



Answers (if you have not attended live lecture)

- Q1 – A
- Q2 – A
- Q3 – B
- Q4 – C
- Q5 – D

SECaTs for Semester 1, 2024

13 May – 31 May (11:59 pm AEST)

What are the benefits of completing the survey?

The SECaT is your opportunity to provide feedback on your learning experience!

Your responses will be used to improve courses and teaching for future students. Please be assured that all responses are strictly confidential.

How do I complete the survey?

Visit <https://eval.uq.edu.au/eus.onlinesurveyportal/> or scan this QR code:



Please provide specific examples where possible. Respectful constructive feedback is always helpful to help improve your learning experience.



Interested in Learning JS, React and React Native?

Web/Mobile Programming (COMP2140)

Course level
Undergraduate
Faculty
Engineering, Architecture & Information Technology
School
Elec Engineering, Comp Science
Units
2
Duration
One Semester
Class hours
Lecture 1.5 Hours/ Week General contact hours 3.5 Hours/ Week
Prerequisite
DECO1400 and (CSSE1001 or ENGG1001)
Assessment methods

Current course offerings

Course offerings	Location	Mode	Course Profile
Semester 2, 2024 (22/07/2024 - 18/11/2024)	St Lucia	In Person	PROFILE UNAVAILABLE

Please Note: Course profiles marked as not available may still be in development.

Course description

In this course, students will build knowledge of functional programming with JavaScript, culminating in the production of interactive, cross-platform web/native apps using JavaScript frameworks. Throughout, students will consider & evaluate challenges posed by cross-platform architectures, testing their design & code approaches of web/native apps.

Archived offerings

Course offerings	Location	Mode	Course Profile
Semester 2, 2023 (24/07/2023 - 18/11/2023)	St Lucia	In Person	COURSE PROFILE
Semester 2, 2022 (25/07/2022 - 19/11/2022)	External	External	COURSE PROFILE
Semester 2, 2022 (25/07/2022 - 19/11/2022)	St Lucia	Internal	COURSE PROFILE

Thank you



CREATE CHANGE