Advanced Mobile Application Development
Week 8: iOS and Firebase

Firebase
https://firebase.google.com/
Google's Firebase is a backend-as-a-service (BaaS) that allows you to get an app with a server-side real-time database up and running very quickly. Providing this as a service means you don't have to set up a database, write all the code to synchronize the data, and figure out security and authentication. Firebase stores data as JSON in the cloud in a NoSQL database.
With SDKs available for the web, Android, iOS, and a REST API it lets you easily sync data across devices/clients on iOS, Android, and the Web.

Features: https://firebase.google.com/products/

- Database
- Cloud Storage
- Authentication
- Hosting
- Cross platform support – web, iOS, Android

Firebase was founded by Andrew Lee and James Tamplin in 2011, officially launched in April 2012, and purchased by Google two years later.

Get Started
https://firebase.google.com/docs/firestore/quickstart
Get started by logging in with your Google login to create a Firebase account
Create a new Firebase project called Recipes.
A project in Firebase stores data that can be accessed across multiple platforms so you can have an iOS, Android, and web app all sharing the same project data. For completely different apps use different projects.
Firebase has two databases, the Realtime Database (Firebase) and Cloud Firestore. Both are noSQL databases but Firestore is their newer version so we'll use that. (Be careful of the difference between Firebase and Firestore online as they're different and have different structures, methods, etc)
Then you'll be taken to the dashboard where you can manage the Firebase project.
https://console.firebase.google.com
From the console's navigation pane, select **Database**, then click **Create database** for Cloud Firestore.

- Start in test mode.
  - Good for getting started with the mobile and web client libraries
  - Allows anyone to read and overwrite your data.
- Select the multi-regional location nam5(us-central)

Cloud Firestore
https://firebase.google.com/docs/firestore
Cloud Firestore is a flexible, scalable NoSQL database for mobile, web, and server development. It keeps your data in sync across client apps through real-time listeners and offers offline support for mobile and web.

Data Model
https://firebase.google.com/docs/firestore/data-model
Cloud Firestore is a NoSQL, document-oriented database. Unlike a SQL database, there are no tables or rows. Instead, you store data in documents, which are organized into collections.

Documents

- Document is the unit of storage
- A document is a lightweight record that contains fields, which map to values.
- Each document is identified by a unique id or name
- Each document contains a set of key-value pairs.
- All documents must be stored in collections.
- Documents within the same collection can all contain different fields or store different types of data in those fields.
- However, it's a good idea to use the same fields and data types across multiple documents, so that you can query the documents more easily.
- The names of documents within a collection are unique. You can provide your own keys, such as user IDs, or you can let Cloud Firestore create random IDs for you automatically.

Collection

- A collection is a container for documents
- A collection contains documents and nothing else.
- A collection can't directly contain raw fields with values, and it can't contain other collections.
- You can use multiple collections for different related data (orders vs users)

You do not need to "create" or "delete" collections. After you create the first document in a collection, the collection exists.

Every document in Cloud Firestore is uniquely identified by its location within the database. To refer to a location in your code, you can create a *reference* to it.
A reference is a lightweight object that just points to a location in your database. You can create a reference to a collection or a document.

```
let db = Firestore.firestore()
let collection = db.collection("restaurants")

let document = collection.document(id)
```

Let’s create a collection and the first document using the console so we know our collection exists.

In the console go into Firestore Database | Cloud Firestore | Data
Create a collection called recipes.
Now create a document using auto id with the fields name, and url.

Note that because we’re in test mode our security rules are public and you’ll see the following in the rules tab:

```
rules_version = '2';
service cloud.firestore {
  match /databases/{database}/documents {
    match /{document=**} {
      allow read, write;
    }
  }
}
```

You'll want to change this when not in test mode or when using authentication.

Firebase and iOS
https://firebase.google.com/docs/ios/setup
Before we go further let's create an app in Xcode and get Firebase integrated.
Create a new app in Xcode called Recipes.
In Xcode go into the target's general tab and copy the bundle identifier.
Back in the Firebase console in Project settings | General click the "Add App" button, select iOS and follow the steps.

1. Paste in the iOS bundle ID
2. Download the GoogleService-Info.plist file
    a. Drag the file into your Xcode project making sure "Copy items" is checked and your target is checked. (or File | Add Files to project)

Close the project in Xcode.

Swift Package Manager
Starting in Firebase 8 Swift package manager is supported so we'll use that to install and manage Firebase dependencies.
In Xcode go to File > Add Packages and search for the Firebase Apple platforms SDK repository:
`https://github.com/firebase/firebase-ios-sdk.git`
Next, set the Dependency Rule to be Up to Next Major Version and specify 8.10.0 as the lower bound.
Add Package.
Choose the Firebase libraries you want to use.
FirebaseFireStore
FirebaseFirestoreSwift-Beta

Xcode setup
To connect Firebase when your app starts up, add initialization code to your AppDelegate class.

```
import Firebase

    func application(_ application: UIApplication,
didFinishLaunchingWithOptions launchOptions: [UIApplicationLaunchOptionsKey:
Any]?) -> Bool {
        // Override point for customization after application launch.
        //initializes installed Firebase libraries
        FirebaseApp.configure()
        return true
    }
```

If you get an error that the Firebase module is not found you might need to build your project (cmd B)

Read Data
There are two ways to retrieve data stored in Cloud Firestore. Either of these methods can be used with documents, collections of documents, or the results of queries:

- Call a method to get the data.
- Set a listener to receive data-change events.

Methods:
https://firebase.google.com/docs/firestore/query-data/get-data

Get a single document:

```
let docRef = db.collection("cities").document("SF")

docRef.getDocument { (document, error) in
    if let document = document, document.exists {
        let dataDescription =
document.data().map(String.init(describing:)) ?? "nil"
        print("Document data: \(dataDescription)")
    } else {
        print("Document does not exist")
    }
}
```

Get a single document and convert it to an object of your model class that adopts the Codable protocol (field names must match).

```
let docRef = db.collection("cities").document("BJ")

docRef.getDocument { (document, error) in
    let result = Result {
      try document?.data(as: City.self)
    }
    // parse document
}
```

Get multiple documents from a collection. You then need to loop through the result or access the one you want. You can use the various where() methods to define your query.

```
db.collection("cities").getDocuments() { (querySnapshot, err) in
    if let err = err {
        print("Error getting documents: \(err)")
    } else {
        for document in querySnapshot!.documents {
            // parse document
        }
    }
}
```

Listeners:
https://firebase.google.com/docs/firestore/query-data/listen
When you set a listener, Cloud Firestore sends your listener an initial snapshot of the data, and then another snapshot each time the document changes.

You can listen to a document with the onSnapshot() method. When listening for changes to a document, collection, or query, you can pass options to control the granularity of events that your listener will receive.

```
db.collection("cities").document("SF")
    .addSnapshotListener { documentSnapshot, error in
      guard let document = documentSnapshot else {
        print("Error fetching document: \(error!)")
```

```
        return
      }
      guard let data = document.data() else {
        print("Document data was empty.")
        return
      }
      // parse document
    }
```

An initial call using the callback you provide creates a document snapshot immediately with the current contents of the single document. Then, each time the contents change, another call updates the document snapshot.
Local writes in your app will invoke snapshot listeners immediately. This is because of a feature called "latency compensation." When you perform a write, your listeners will be notified with the new data before the data is sent to the backend.

Queries:
https://firebase.google.com/docs/firestore/query-data/queries
Cloud Firestore provides powerful query functionality for specifying which documents you want to retrieve from a collection or collection group. These queries can also be used with both the methods and listeners above.
By default, a query retrieves all documents that satisfy the query in ascending order by document ID. You can specify the sort order for your data using orderBy(), and you can limit the number of documents retrieved using limit().

Write Data
https://firebase.google.com/docs/firestore/manage-data/add-data
When you write a document to a collection in Cloud Firestore each document needs an identifier. You can explicitly specify a document identifier or have Cloud Firestore automatically generate it. You can also create an empty document with an automatically generated identifier, and assign data to it later.

.setData(data) creates or overwrites a single document and requires a document identifier.
.addDocument(data) adds a document and automatically generates a document identifier for you.
.updateData() lets you update some fields of a document without overwriting the entire document.

Delete Data
.delete() deletes a specific document
Note that deleting a document does NOT delete any subcollections it might have.

To delete an entire collection or subcollection in Cloud Firestore, retrieve all the documents within the collection or subcollection and delete them. This is not recommended from a mobile client.

Access Data Offline
https://firebase.google.com/docs/firestore/manage-data/enable-offline
Cloud Firestore supports offline data persistence. A copy of the Cloud Firestore data that your app is actively using will be cached so your app can access the data when the device is offline. You can write, read, listen to, and query the cached data. When the device comes back online, Cloud Firestore synchronizes any local changes made by your app to the Cloud Firestore backend.

- For Android and iOS, offline persistence is enabled by default. To disable persistence, set the PersistenceEnabled option to false
- For the web, offline persistence is disabled by default

Xcode
Go into the Storyboard and delete the view controller.
Add a table view controller.
Embed the table view controller in a navigation controller. In the attributes inspector check Is Initial View Controller.
Select the table view cell and make the style Basic and give it a reuse identifier "Cell".
Select the navigation item in the table view controller and make the title "Recipes".
Add a bar button on the right and change System Item to Add.
Add a View Controller to the right of the Table View Controller.
Add a navigation bar to the top and set its title to "Add Recipe".
Add a bar button item on the right side of the navigation bar and change it to Save.
Add a bar button item on the left side of the navigation bar and change it to Cancel.
Add a label and textfield for the user to add a recipe name.
Add another textfield for the url (I added default text of http://).
Use auto layout to add needed constraints for this view, including the navigation bar.

Rename ViewController.swift to AddRecipeViewController.
Add a Cocoa touch class called RecipeTableViewController and subclass UITableViewController.

In order to navigate back create an unwind method in RecipeTableViewController.swift

```
    @IBAction func unwindSegue(segue:UIStoryboardSegue){
    }
```

Back in the storyboard change the two controllers to use these classes.
In the AddRecipeViewController connect the textfields in Add Recipe as nameTextField and urlTextField respectively.

Create an action segue Present Modally from the Add bar button (use the document hierarchy) to the AddRecipeViewController and give it the identifier "addrecipe".

In the storyboard connect the Cancel and Save button to the Exit icon and chose the unwindSegue method. Name the segues "cancelsegue" and "savesegue".

You should be able to run it and navigate back and forth.

Data Model
Create a struct called Recipe for your data model.
We need to import FirebaseFirestoreSwift in order to use Firestore's Swift extensions.
Note the properties in our struct have the same names as the fields in Firestore documents.

```
import FirebaseFirestoreSwift

struct Recipe: Codable, Identifiable {
    @DocumentID var id: String?
    var name: String
    var url: String
```

```
}
```

The Recipe struct must adopt the Codable protocol and the data member names must match the keys in the documents in Firestore (or use coding keys) so Swift can convert a Firestore document to an instance of our custom class.
The Identifiable protocol enables you to define a property, in our case id, that is unique.
@DocumentID marks a property so Firestore will automatically map the document ID to the id attribute. We need this unique id so later we know which document the user is trying to access, such as in a delete or update, in Firestore.

Accessing Firestore Data
Let's create a new data handler class RecipeDataHandler to handle the data in Firestore.

We need to import Firebase in order to use it.

```
import FirebaseFirestore
import FirebaseFirestoreSwift
```

In RecipeDataHandler you need to define a Firebase database reference. This is called a reference because it refers to a location in Firebase where data is stored. It knows which database to reference from the data in your GoogleService-Info.plist file.

Firebase iOS Getting Started https://firebase.google.com/docs/firestore/quickstart#ios

```
class RecipeDataHandler {
    let db = Firestore.firestore()
}
```

We also need an array of recipes to hold our recipe data.

```
var recipeData = [Recipe]()
```

Firebase iOS Read and Write Data https://firebase.google.com/docs/firestore/query-data/listen#swift

Now we need to set up a method that will get the data from Firebase and store it in our array.

```
    func getFirebaseData() async {
        do {
            let snapshot = try await db.collection("recipes").getDocuments()
            self.recipeData = snapshot.documents.compactMap {document-
>Recipe? in
                return try? document.data(as: Recipe.self)
            }
            print(self.recipeData)
        }
        catch{
            print ("Error fetching document: \(error.localizedDescription)")
           }
    }
```

We mark this method as async as it's calling an asynchronous method, getDocuments() over the network
We mark getDocuments() with await so execution will wait until that method returns before continuing.

The getDocuments() method returns all the documents from our recipes collection. Then we need to parse these documents into our data model.
compactMap(_:) iterates over all the documents and returns an array. It takes a closure that accepts an element(document) of this sequence(documents) as its argument and returns an instance of type Recipe in each iteration, resulting in an array.
The data(as:) method, which is provided by the FirebaseFirestoreSwift module, takes in a decodable struct and will map every document to that type and return an instance.
Note that the Recipe struct must adopt the Codable protocol and the data member names must match the keys in the documents in Firebase (or use coding keys).

Because Firestore itself doesn't require each document in a collection to look the same, it is possible to have documents that can't be converted to the struct you have specified.

We also need a method to return the array of recipes.

```
    func getRecipes()->[Recipe]{
        return recipeData
    }
```

In RecipeTableViewController we need an array of recipes to hold our recipe data and an instance of our RecipeDataHandler class.

```
var recipes = [Recipe]()
var recipeDataHandler = RecipeDataHandler()
```

We'll create a method that we want to call whenever we need to get the data from Firebase. Note that we also reload the tableview to ensure it reflects the updated data.

```
    func getData(){
        Task {
            await recipeDataHandler.getFirebaseData()
            recipes = recipeDataHandler.getRecipes()
            print("Table Recipes \(recipes.count)")
            tableView.reloadData()
        }
    }
```

Then in viewDidLoad() we call this method to get the initial data.

```
    override func viewDidLoad() {
        super.viewDidLoad()
        getData()
    }
```

Update the table view delegate methods as usual.

```
override func numberOfSections(in tableView: UITableView) -> Int {
      return 1
    }

    override func tableView(_ tableView: UITableView, numberOfRowsInSection
section: Int) -> Int {
      return recipes.count
    }
```

```
    override func tableView(_ tableView: UITableView, cellForRowAt
indexPath: IndexPath) -> UITableViewCell {
        let cell = tableView.dequeueReusableCell(withIdentifier: "Cell",
for: indexPath)
        var cellConfig = cell.defaultContentConfiguration()
        cellConfig.text = recipes[indexPath.row].name
        cell.contentConfiguration = cellConfig
        return cell
    }
```

You should now be able to run the app and see the data you entered directly into Firestore.

Writing Data

Now let's save new recipes and write them to Firestore.
In RecipeDataHandler add a method to save a new recipe.

```
    func addRecipe(name:String, url:String){
        let recipeCollection = db.collection("recipes")

        //create Dictionary
        let newRecipeDict = ["name": name, "url": url]

        // Add a new document with a generated id
        var ref: DocumentReference? = nil
        ref = recipeCollection.addDocument(data: newRecipeDict)
        {err in
            if let err = err {
                print("Error adding document: \(err)")
            } else {
                print("Document added with ID: \(ref!.documentID)")
            }
        }
    }
```

In AddRecipeViewController add variables for the recipe name and url and implement prepareForSegue.

```
    var addedrecipe = String()
    var addedurl = String()

    override func prepare(for segue: UIStoryboardSegue, sender: Any?) {
        if segue.identifier == "savesegue"{
            if nameTextField.text?.isEmpty == false {
                addedrecipe = nameTextField.text!
                addedurl = urlTextField.text!
            }
        }
    }
```

Back in RecipeTableViewController let's update unwindsegue() to save our data.

```
    @IBAction func unwindSegue(segue:UIStoryboardSegue){
        if segue.identifier == "savesegue" {
            let source = segue.source as! AddRecipeViewController
```

```
            if source.addedrecipe.isEmpty == false {
                recipeDataHandler.addRecipe(name: source.addedrecipe, url:
source.addedurl)
                getData()
            }
        }
    }
```

I'm also calling getData() to make sure the app has the latest data from Firestore.

Note: I'm not checking that a url was entered or that it's a valid url, this should be done at some point.
To make typing in the simulator easier you might want to set it to use an external keyboard.
When you run this, check in Firestore to make sure the data was added.

Deleting items

To delete items from Firestore let's add a method to RecipeDataHandler

```
    func deleteRecipe(recipeID: String){
        // Delete the object from Firestore
        db.collection("recipes").document(recipeID).delete() { err in
            if let err = err {
                print("Error removing document: \(err)")
            } else {
                print("Document successfully removed!")
            }
        }
    }
```

If you want the Edit button visible in RecipeTableViewController in viewDidLoad uncomment the following line and update it so the edit button will be on the left since the add is on the right. This is optional as we can enable swipe to delete without it.

```
        self.navigationItem.leftBarButtonItem = self.editButtonItem
```

In RecipeTableViewController uncomment and implement these delegate methods

```
    override func tableView(_ tableView: UITableView, canEditRowAt
indexPath: IndexPath) -> Bool {
      return true
    }

    override func tableView(_ tableView: UITableView, commit editingStyle:
UITableViewCell.EditingStyle, forRowAt indexPath: IndexPath) {
        if editingStyle == .delete {
            // Delete the row from the data source
            if let recipeID = recipes[indexPath.row].id {
                recipeDataHandler.deleteRecipe(recipeID: recipeID)
                getData()
            }
        }
    }
```

Detail View

In the main storyboard add a new view controller and add a WebKit view that fills up the whole view. Add an activity indicator on top of the web view. (it must be below the web view in the document hierarchy). In the attributes inspector check Animating and Hides When Stopped but make sure Hidden is unchecked (below under Drawing)

Create a new Cocoa Touch class called WebViewController that subclasses UIViewController to control this view.

Back in the storyboard change the scene to use this new class.

Connect the web view and activity indicator as outlets named webView and webSpinner.

Setup needed autoresizing/constraints.

Create a Selection show segue from the RecipeTableViewController cell to the new web view controller and give it an identifier "showdetail".

Before leaving the storyboard go to the recipes scene and change the accessory on the cell to a disclosure indicator to give the user the visual cue that selecting the row will lead to more information.

In WebViewController you will have an error because the WKWebView class is in the WebKit framework so we need to import that. We will also need to adopt the WKNavigationDelegate protocol.

```
import WebKit
class WebViewController: UIViewController, WKNavigationDelegate
```

Define a variable to hold the web address.

```
var webpage : String?
```

Create a method to load a web page.

```
    func loadWebPage(_ urlString: String){
        //create a URL object
        let url = URL(string: urlString)
        //create a URLRequest object
        let request = URLRequest(url: url!)
        //load the URLRequest object in our web view
        webView.load(request)
    }
```

In viewDidLoad() set up the web view's delegate.

Call the loadWebPage method and test to see if no web page was entered. We really should also check that the url is valid so the view doesn't hang or crash.

```
      webView.navigationDelegate = self

        if webpage == "" {
            loadWebPage("https://www.myrecipes.com/")
        } else {
            loadWebPage(webpage!)
        }
```

Implement the two delegate methods that are called when the web page starts and stops loading.

```
    //WKNavigationDelegate method that is called when a web page begins to
load
    func webView(_ webView: WKWebView, didStartProvisionalNavigation
navigation: WKNavigation!) {
        webSpinner.startAnimating()
```

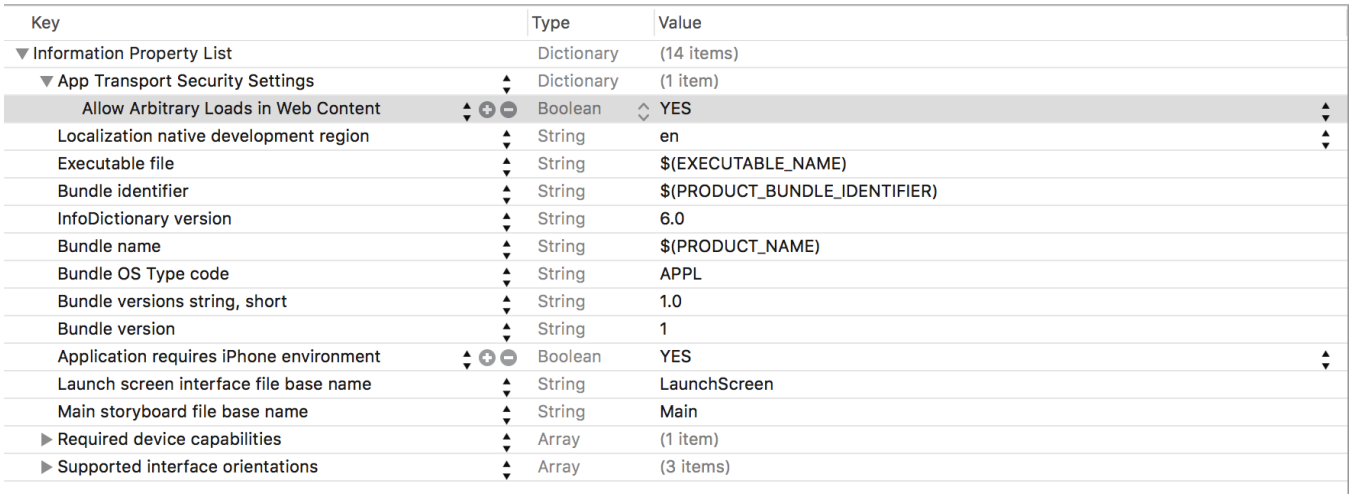
```
    }

    //WKNavigationDelegate method that is called when a web page loads
successfully
    func webView(_ webView: WKWebView, didFinish navigation: WKNavigation!)
{
        webSpinner.stopAnimating()
    }
```

In RecipeTableViewController implement prepare(for:) to send the detail view the data it needs.

```
    override func prepare(for segue: UIStoryboardSegue, sender: Any?) {
        if segue.identifier == "showdetail" {
            let detailVC = segue.destination as! WebViewController
            let indexPath = tableView.indexPath(for: sender as!
UITableViewCell)!
            let recipe = recipes[indexPath.row]
            //sets the data for the destination controller
            detailVC.title = recipe.name
            detailVC.webpage = recipe.url
        }
    }
```

With Apple's updated app transport security to load web pages not available through https you need to add the following to your Info.plist

```
<key>NSAppTransportSecurity</key>
<dict>
       <key>NSAllowsArbitraryLoadsInWebContent</key>
       <true/>
</dict>
```



Key	Type	Value
▼ Information Property List	Dictionary	(14 items)
▼ App Transport Security Settings	Dictionary	(1 item)
Allow Arbitrary Loads in Web Content	Boolean	YES
Localization native development region	String	en
Executable file	String	$(EXECUTABLE_NAME)
Bundle identifier	String	$(PRODUCT_BUNDLE_IDENTIFIER)
InfoDictionary version	String	6.0
Bundle name	String	$(PRODUCT_NAME)
Bundle OS Type code	String	APPL
Bundle versions string, short	String	1.0
Bundle version	String	1
Application requires iPhone environment	Boolean	YES
Launch screen interface file base name	String	LaunchScreen
Main storyboard file base name	String	Main
▶ Required device capabilities	Array	(1 item)
▶ Supported interface orientations	Array	(3 items)