

Apex Triggers

1. Get Started with Apex Triggers

Create an Apex trigger

Create an Apex trigger that sets an account's Shipping Postal Code to match the Billing Postal Code if the Match Billing Address option is selected. Fire the trigger before inserting an account or updating an account.

Pre-Work:

Add a checkbox field to the Account object:

- Field Label: Match Billing Address
- Field Name: Match_Billing_Address
Note: The resulting API Name should be Match_Billing_Address__c.
- Create an Apex trigger:
 - Name: AccountAddressTrigger
 - Object: **Account**
 - Events: before insert and before update
 - Condition: Match Billing Address is true

Operation: set the Shipping Postal Code to match the Billing Postal Code

Code for AccountAddressTrigger

trigger AccountAddressTrigger on Account (before insert, before update) {

```
    for(Account account:Trigger.New){
        if(account.Match_Billing_Address__c == True){
            account.ShippingPostalCode = account.BillingPostalCode;
        }
    }
}
```

2.Bulk Apex Triggers

Create a Bulk Apex trigger

Create a bulkified Apex trigger that adds a follow-up task to an opportunity if its stage is Closed Won. Fire the Apex trigger after inserting or updating an opportunity.

- Create an Apex trigger:
 - Name: `ClosedOpportunityTrigger`
 - Object: **Opportunity**
 - Events: after insert and after update
 - Condition: Stage is `Closed Won`
 - Operation: Create a task:
 - Subject: `Follow Up Test Task`
 - `WhatId`: the opportunity ID (associates the task with the opportunity)
 - Bulkify the Apex trigger so that it can insert or update 200 or more opportunities

Code for ClosedOpportunityTrigger

```
trigger ClosedOpportunityTrigger on Opportunity (after insert, after update) {
    List<Task> tasklist=new List<Task>();

    for(Opportunity opp: Trigger.New){
        if(opp.StageName == 'Closed Won'){
            tasklist.add(new Task(Subject= 'Follow Up Test Task', WhatId=opp.Id));
        }
    }
    if(tasklist.size()>0){
        insert tasklist;
    }
}
```

Apex Testing

1. Get Started with Apex Unit Tests

Create a Unit Test for a Simple Apex Class

Create and install a simple Apex class to test if a date is within a proper range, and if not, returns a date that occurs at the end of the month within the range. You'll copy the code for the class from GitHub. Then write unit tests that achieve 100% code coverage.

- Create an Apex class:
 - Name: `VerifyDate`
 - Code: [Copy from GitHub](#)
- Place the unit tests in a separate test class:
 - Name: `TestVerifyDate`
 - Goal: 100% code coverage
- Run your test class at least once

Code for VerifyDate

```
public class VerifyDate {

    //method to handle potential checks against two dates
    public static Date CheckDates(Date date1, Date date2) {
        //if date2 is within the next 30 days of date1, use date2. Otherwise use the
end of the month
        if(DateWithin30Days(date1,date2)) {
            return date2;
        } else {
            return SetEndOfMonthDate(date1);
        }
    }

    //method to check if date2 is within the next 30 days of date1
    private static Boolean DateWithin30Days(Date date1, Date date2) {
        //check for date2 being in the past
        if( date2 < date1) { return false; }
```

```

//check that date2 is within (>=) 30 days of date1
Date date30Days = date1.addDays(30); //create a date 30 days away from date1
    if( date2 >= date30Days ) { return false; }
    else { return true; }
}

//method to return the end of the month of a given date
private static Date SetEndOfMonthDate(Date date1) {
    Integer totalDays = Date.daysInMonth(date1.year(), date1.month());
    Date lastDay = Date.newInstance(date1.year(), date1.month(), totalDays);
    return lastDay;
}
}

```

Code for TestVerifyDate

```

@isTest
public class TestVerifyDate
{
    static testMethod void testMethod1()
    {
        Date d = VerifyDate.CheckDates(System.today(),System.today()+1);
        Date d1 = VerifyDate.CheckDates(System.today(),System.today()+60);
    }
}

```

2.Test Apex Triggers

Create a Unit Test for a Simple Apex Trigger

Create and install a simple Apex trigger which blocks inserts and updates to any contact with a last name of 'INVALIDNAME'. You'll copy the code for the class from GitHub. Then write unit tests that achieve 100% code coverage.

- Create an Apex trigger on the Contact object
 - Name: RestrictContactByName

- Code: [Copy from GitHub](#)
- Place the unit tests in a separate test class
 - Name: `TestRestrictContactByName`
 - Goal: 100% test coverage
- Run your test class at least once

Code for RestrictContactByName

trigger RestrictContactByName on Contact (before insert, before update) {

```
//check contacts prior to insert or update for invalid data
For (Contact c : Trigger.New) {
  if(c.LastName == 'INVALIDNAME') {    //invalidname is invalid
    c.AddError('The Last Name "'+c.LastName+'" is not allowed for DML');
  }

}

}
```

Code for TestRestrictContactByName

```
@isTest
private class TestRestrictContactByName {

  static testMethod void metodoTest()
  {

    List<Contact> listContact= new List<Contact>();
    Contact c1 = new Contact(FirstName='Francesco', LastName='Riggio' ,
email='Test@test.com');
    Contact c2 = new Contact(FirstName='Francesco1', LastName =
'INVALIDNAME',email='Test@test.com');
    listContact.add(c1);
    listContact.add(c2);
```

```

Test.startTest();
    try
    {
        insert listContact;
    }
    catch(Exception ee)
    {
    }

Test.stopTest();

}

}

```

3.Create Test Data for Apex Tests

Create a Contact Test Factory

Create an Apex class that returns a list of contacts based on two incoming parameters: the number of contacts to generate and the last name. Do not insert the generated contact records into the database.

NOTE: For the purposes of verifying this hands-on challenge, don't specify the `@isTest` annotation for either the class or the method, even though it's usually required.

- Create an Apex class in the `public` scope
 - Name: `RandomContactFactory` (without the `@isTest` annotation)
- Use a Public Static Method to consistently generate contacts with unique first names based on the iterated number in the format Test 1, Test 2 and so on.
 - Method Name: `generateRandomContacts` (without the `@isTest` annotation)
 - Parameter 1: An integer that controls the number of contacts being generated with unique first names
 - Parameter 2: A string containing the last name of the contacts
 - Return Type: `List < Contact >`

Code for RandomContactFactory

```
public class RandomContactFactory {  
    public static List<Contact> generateRandomContacts(Integer  
numContactsToGenerate, String FName) {  
        List<Contact> contactList = new List<Contact>();  
  
        for(Integer i=0;i<numContactsToGenerate;i++) {  
            Contact c = new Contact(FirstName=FName + ' ' + i, LastName = 'Contact ' +i);  
            contactList.add(c);  
            System.debug(c);  
        }  
        //insert contactList;  
        System.debug(contactList.size());  
        return contactList;  
    }  
}
```

Asynchronous Apex

2.Use Future Methods

Create an Apex class that uses the @future annotation to update Account records.

Create an Apex class with a future method that accepts a List of Account IDs and updates a custom field on the Account object with the number of contacts associated to the Account. Write unit tests that achieve 100% code coverage for the class. Every hands-on challenge in this module asks you to create a test class.

- Create a field on the Account object:
 - Label: Number Of Contacts
 - Name: Number_Of_Contacts
 - Type: **Number**
 - This field will hold the total number of Contacts for the Account
- Create an Apex class:
 - Name: AccountProcessor

- Method name: `countContacts`
- The method must accept a List of Account IDs
- The method must use the `@future` annotation
- The method counts the number of Contact records associated to each Account ID passed to the method and updates the 'Number_Of_Contacts__c' field with this value
- Create an Apex test class:
 - Name: `AccountProcessorTest`
 - The unit tests must cover all lines of code included in the **AccountProcessor** class, resulting in 100% code coverage.
- Before verifying this challenge, run your test class at least once using the Developer Console Run All feature

Code for AccountProcessor

```
public class AccountProcessor {
    @future
    public static void countContacts(List<Id> accountIds){
        List<Account> accounts = [Select Id, Name from Account Where Id IN : accountIds];
        List<Account> updatedAccounts = new List<Account>();
        for(Account account : accounts){
            account.Number_of_Contacts__c = [Select count() from Contact Where AccountId
=: account.Id];
            System.debug('No Of Contacts = ' + account.Number_of_Contacts__c);
            updatedAccounts.add(account);
        }
        update updatedAccounts;
    }
}
```

Code for AccountProcessorTest

```
@isTest
public class AccountProcessorTest {
    @isTest
    public static void testNoOfContacts(){
```



```

Account a = new Account();
a.Name = 'Test Account';
Insert a;

Contact c = new Contact();
c.FirstName = 'Bob';
c.LastName = 'Willie';
c.AccountId = a.Id;

Contact c2 = new Contact();
c2.FirstName = 'Tom';
c2.LastName = 'Cruise';
c2.AccountId = a.Id;

List<Id> acctIds = new List<Id>();
acctIds.add(a.Id);

Test.startTest();
AccountProcessor.countContacts(acctIds);
Test.stopTest();
}

}

```

3. Use Batch Apex

Create an Apex class that uses Batch Apex to update Lead records.

Create an Apex class that implements the Database.Batchable interface to update all Lead records in the org with a specific LeadSource.

- Create an Apex class:
 - Name: `LeadProcessor`
 - Interface: `Database.Batchable`
 - Use a `QueryLocator` in the start method to collect all Lead records in the org
 - The execute method must update all Lead records in the org with the LeadSource value of `Dreamforce`

- Create an Apex test class:
 - Name: `LeadProcessorTest`
 - In the test class, insert 200 Lead records, execute the `LeadProcessor Batch` class and test that all Lead records were updated correctly
 - The unit tests must cover all lines of code included in the **LeadProcessor** class, resulting in 100% code coverage
- Before verifying this challenge, run your test class at least once using the Developer Console Run All feature

Code for LeadProcessor

```
public class LeadProcessor implements Database.Batchable<sObject> {

    public Database.QueryLocator start(Database.BatchableContext bc) {
        // collect the batches of records or objects to be passed to execute
        return Database.getQueryLocator([Select LeadSource From Lead ]);
    }

    public void execute(Database.BatchableContext bc, List<Lead> leads){
        // process each batch of records
        for (Lead Lead : leads) {
            lead.LeadSource = 'Dreamforce';
        }
        update leads;
    }

    public void finish(Database.BatchableContext bc){
    }

}
```

Code for LeadProcessorTest

```
@isTest
public class LeadProcessorTest {

    @testSetup
    static void setup() {
        List<Lead> leads = new List<Lead>();
    }
}
```

```

for(Integer counter=0 ;counter <200;counter++){
    Lead lead = new Lead();
    lead.FirstName = 'FirstName';
    lead.LastName = 'LastName'+counter;
    lead.Company = 'demo'+counter;
    leads.add(lead);
}
insert leads;
}

@isTest static void test() {
    Test.startTest();
    LeadProcessor leadProcessor = new LeadProcessor();
    Id batchId = Database.executeBatch(leadProcessor);
    Test.stopTest();
}

}

```

4.Control Processes with Queueable Apex

Create a Queueable Apex class that inserts Contacts for Accounts.

Create a Queueable Apex class that inserts the same Contact for each Account for a specific state.

- Create an Apex class:
 - Name: AddPrimaryContact
 - Interface: Queueable
 - Create a constructor for the class that accepts as its first argument a Contact sObject and a second argument as a string for the State abbreviation
 - The `execute` method must query for a maximum of 200 Accounts with the `BillingState` specified by the State abbreviation passed into the constructor and insert the Contact sObject record associated to each Account. Look at the sObject `clone()` method.
- Create an Apex test class:

- Name: AddPrimaryContactTest
- In the test class, insert 50 Account records for BillingState NY and 50 Account records for BillingState CA
- Create an instance of the AddPrimaryContact class, enqueue the job, and assert that a Contact record was inserted for each of the 50 Accounts with the BillingState of CA
- The unit tests must cover all lines of code included in the **AddPrimaryContact** class, resulting in 100% code coverage
- Before verifying this challenge, run your test class at least once using the Developer Console Run All feature

Code for AddPrimaryContact

```
public class AddPrimaryContact implements Queueable
{
    private Contact c;
    private String state;
    public AddPrimaryContact(Contact c, String state)
    {
        this.c = c;
        this.state = state;
    }
    public void execute(QueueableContext context)
    {
        List<Account> ListAccount = [SELECT ID, Name ,(Select id,FirstName,LastName
from contacts ) FROM ACCOUNT WHERE BillingState = :state LIMIT 200];
        List<Contact> lstContact = new List<Contact>();
        for (Account acc:ListAccount)
        {
            Contact cont = c.clone(false,false,false,false);
            cont.AccountId = acc.id;
            lstContact.add( cont );
        }

        if(lstContact.size() >0 )
        {
            insert lstContact;
        }
    }
}
```

```

    }

}

}

```

Code for AddPrimaryContactTest

```

@Test
public class AddPrimaryContactTest
{
    @Test static void TestList()
    {
        List<Account> Teste = new List <Account>();
        for(Integer i=0;i<50;i++)
        {
            Teste.add(new Account(BillingState = 'CA', name = 'Test'+i));
        }
        for(Integer j=0;j<50;j++)
        {
            Teste.add(new Account(BillingState = 'NY', name = 'Test'+j));
        }
        insert Teste;

        Contact co = new Contact();
        co.FirstName='demo';
        co.LastName = 'demo';
        insert co;
        String state = 'CA';

        AddPrimaryContact apc = new AddPrimaryContact(co, state);
        Test.startTest();
        System.enqueueJob(apc);
        Test.stopTest();
    }
}

```

5.Schedule Jobs Using the Apex Scheduler

Create an Apex class that uses Scheduled Apex to update Lead records.

Create an Apex class that implements the Schedulable interface to update Lead records with a specific LeadSource. (This is very similar to what you did for Batch Apex.)

- Create an Apex class:
 - Name: `DailyLeadProcessor`
 - Interface: `Schedulable`
 - The execute method must find the first 200 Lead records with a blank LeadSource field and update them with the LeadSource value of `Dreamforce`
- Create an Apex test class:
 - Name: `DailyLeadProcessorTest`
 - In the test class, insert 200 Lead records, schedule the `DailyLeadProcessor` class to run and test that all Lead records were updated correctly
 - The unit tests must cover all lines of code included in the **DailyLeadProcessor** class, resulting in 100% code coverage.
- Before verifying this challenge, run your test class at least once using the Developer Console Run All feature

Code for DailyLeadProcessor

```
public class DailyLeadProcessor implements Schedulable {  
    Public void execute(SchedulableContext SC){  
        List<Lead> LeadObj=[SELECT Id from Lead where LeadSource=null limit 200];  
        for(Lead l:LeadObj){  
            l.LeadSource='Dreamforce';  
            update l;  
        }  
    }  
}
```

Code for DailyLeadProcessorTest

```
@isTest
private class DailyLeadProcessorTest {
    static testMethod void testDailyLeadProcessor() {
        String CRON_EXP = '0 0 1 * * ?';
        List<Lead> lList = new List<Lead>();
        for (Integer i = 0; i < 200; i++) {
            List.add(new Lead(LastName='Dreamforce'+i, Company='Test1 Inc.', Status='Open - Not
            Contacted'));
        }
        insert lList;

        Test.startTest();
        String jobId = System.schedule('DailyLeadProcessor', CRON_EXP, new
        DailyLeadProcessor());
    }
}
```

Apex Integration Services

2.Apex REST Callouts

Create an Apex class that calls a REST endpoint and write a test class.

Create an Apex class that calls a REST endpoint to return the name of an animal, write unit tests that achieve 100% code coverage for the class using a mock response, and run your Apex tests.

Prework: Be sure the Remote Sites from the first unit are set up.

- Create an Apex class:
 - Name: `AnimalLocator`
 - Method name: `getAnimalNameById`
 - The method must accept an Integer and return a String.
 - The method must call `https://th-apex-http-callout.herokuapp.com/animals/<id>`, replacing `<id>` with the ID passed

- into the method
 - The method returns the value of the **name** property (i.e., the animal name)
- Create a test class:
 - Name: `AnimalLocatorTest`
 - The test class uses a mock class called `AnimalLocatorMock` to mock the callout response
- Create unit tests:
 - Unit tests must cover all lines of code included in the **AnimalLocator** class, resulting in 100% code coverage
- Run your test class at least once (via **Run All** tests the Developer Console) before attempting to verify this challenge

Code for AnimalLocator

```
public class AnimalLocator{
    public static String getAnimalNameById(Integer x){
        Http http = new Http();
        HttpRequest req = new HttpRequest();
        req.setEndpoint('https://th-apex-http-callout.herokuapp.com/animals/' + x);
        req.setMethod('GET');
        Map<String, Object> animal= new Map<String, Object>();
        HttpResponse res = http.send(req);
        if (res.getStatusCode() == 200) {
            Map<String, Object> results = (Map<String,
Object>)JSON.deserializeUntyped(res.getBody());
            animal = (Map<String, Object>) results.get('animal');
        }
        return (String)animal.get('name');
    }
}
```

Code for AnimalLocatorMock

```
@isTest
global class AnimalLocatorMock implements HttpCalloutMock {
    // Implement this interface method
```



```

global HTTPResponse respond(HTTPRequest request) {
    // Create a fake response
    HTTPResponse response = new HTTPResponse();
    response.setHeader('Content-Type', 'application/json');
    response.setBody('{"animals": ["majestic badger", "fluffy bunny", "scary bear",
"chicken", "mighty moose"]}');
    response.getStatusCode(200);
    return response;
}
}

```

Code for AnimalLocatorTest

```

@isTest
private class AnimalLocatorTest{
    @isTest static void AnimalLocatorMock1() {
        Test.setMock(HttpCalloutMock.class, new AnimalLocatorMock());
        String result = AnimalLocator.getAnimalNameById(3);
        String expectedResult = 'chicken';
        System.assertEquals(result, expectedResult );
    }
}

```

3.Apex SOAP Callouts

Generate an Apex class using WSDL2Apex and write a test class.

Generate an Apex class using WSDL2Apex for a SOAP web service, write unit tests that achieve 100% code coverage for the class using a mock response, and run your Apex tests.

Prework: Be sure the Remote Sites from the first unit are set up.

- Generate a class using this using [this WSDL file](#):
 - Name: `ParkService` (Tip: After you click the **Parse WSDL** button, change the Apex class name from **parksServices** to `ParkService`)
 - Class must be in public scope

- Create a class:
 - Name: `ParkLocator`
 - Class must have a **country** method that uses the **ParkService** class
 - Method must return an array of available park names for a particular country passed to the web service (such as Germany, India, Japan, and United States)
- Create a test class:
 - Name: `ParkLocatorTest`
 - Test class uses a mock class called `ParkServiceMock` to mock the callout response
- Create unit tests:
 - Unit tests must cover all lines of code included in the **ParkLocator** class, resulting in 100% code coverage.
- Run your test class at least once (via **Run All** tests the Developer Console) before attempting to verify this challenge.

Code for ParkServiceMock

```
@isTest
global class ParkServiceMock implements WebServiceMock {
    global void doInvoke(
        Object stub,
        Object request,
        Map<String, Object> response,
        String endpoint,
        String soapAction,
        String requestName,
        String responseNS,
        String responseName,
        String responseType) {
        // start - specify the response you want to send
        ParkService.byCountryResponse response_x = new
        ParkService.byCountryResponse();
        response_x.return_x = new List<String>{'Yellowstone', 'Mackinac National Park',
        'Yosemite'};
        // end
        response.put('response_x', response_x);
    }
}
```

```
}  
}
```

Code for ParkLocator

```
public class ParkLocator {  
    public static string[] country(string theCountry) {  
        ParkService.ParksImplPort parkSvc = new ParkService.ParksImplPort(); // remove  
space  
        return parkSvc.byCountry(theCountry);  
    }  
}
```

Code for ParkLocatorTest

```
@isTest  
private class ParkLocatorTest {  
    @isTest static void testCallout() {  
        Test.setMock(WebServiceMock.class, new ParkServiceMock ());  
        String country = 'United States';  
        List<String> result = ParkLocator.country(country);  
        List<String> parks = new List<String>{'Yellowstone', 'Mackinac National Park',  
'Yosemite'};  
        System.assertEquals(parks, result);  
    }  
}
```

4.Apex Web Services

Create an Apex REST class that is accessible at /Accounts/<Account_ID>/contacts. The service will return the account's ID and name plus the ID and name of all contacts associated with the account. Write unit tests that achieve 100% code coverage for the class and run your Apex tests.

Prework: Be sure the Remote Sites from the first unit are set up.

- Create an Apex class
 - Name: `AccountManager`
 - Class must have a method called `getAccount`
 - Method must be annotated with **@HttpGet** and return an **Account** object
 - Method must return the **ID** and **Name** for the requested record and all associated contacts with their **ID** and **Name**
- Create unit tests
 - Unit tests must be in a separate Apex class called `AccountManagerTest`
 - Unit tests must cover all lines of code included in the **AccountManager** class, resulting in 100% code coverage
- Run your test class at least once (via **Run All** tests the Developer Console) before attempting to verify this challenge

Code for AccountManager

```
@RestResource(urlMapping='/Accounts/*/contacts')
global class AccountManager {
    @HttpGet
    global static Account getAccount() {
        RestRequest req = RestContext.request;
        String accId = req.requestURI.substringBetween('Accounts/', '/contacts');
        Account acc = [SELECT Id, Name, (SELECT Id, Name FROM Contacts)
                      FROM Account WHERE Id = :accId];
        return acc;
    }
}
```

Code for AccountManagerTest

```
@isTest
private class AccountManagerTest {

    private static testMethod void getAccountTest1() {
```

```

        Id recordId = createTestRecord();
        // Set up a test request
        RestRequest request = new RestRequest();
        request.requestUri = 'https://na1.salesforce.com/services/apexrest/Accounts/'+
recordId + '/contacts' ;
        request.httpMethod = 'GET';
        RestContext.request = request;
        // Call the method to test
        Account thisAccount = AccountManager.getAccount();
        // Verify results
        System.assert(thisAccount != null);
        System.assertEquals('Test record', thisAccount.Name);
    }

    // Helper method
    static Id createTestRecord() {
        // Create test record
        Account TestAcc = new Account(
            Name='Test record');
        insert TestAcc;
        Contact TestCon= new Contact(
            LastName='Test',
            AccountId = TestAcc.id);
        return TestAcc.Id;
    }
}

```

Apex Specialist SuperBadge

2. Automate record creation

Code for MaintenanceRequest

```

trigger MaintenanceRequest on Case (before update, after update) {
    if(Trigger.isUpdate && Trigger.isAfter){
        MaintenanceRequestHelper.updateWorkOrders(Trigger.New, Trigger.OldMap);
    }
}

```

```

    }
}

```

Code for MaintenanceRequestHelper

```

public with sharing class MaintenanceRequestHelper {
    public static void updateWorkOrders(List<Case> updWorkOrders, Map<Id,Case>
nonUpdCaseMap) {
        Set<Id> validIds = new Set<Id>();
        For (Case c : updWorkOrders){
            if (nonUpdCaseMap.get(c.Id).Status != 'Closed' && c.Status == 'Closed'){
                if (c.Type == 'Repair' || c.Type == 'Routine Maintenance'){
                    validIds.add(c.Id);
                }
            }
        }
    }

    //When an existing maintenance request of type Repair or Routine Maintenance is
closed,
    //create a new maintenance request for a future routine checkup.
    if (!validIds.isEmpty()){
        Map<Id,Case> closedCases = new Map<Id,Case>([SELECT Id, Vehicle__c,
Equipment__c, Equipment__r.Maintenance_Cycle__c,
                (SELECT Id,Equipment__c,Quantity__c FROM
Equipment_Maintenance_Items__r)
                FROM Case WHERE Id IN :validIds]);
        Map<Id,Decimal> maintenanceCycles = new Map<ID,Decimal>();

        //calculate the maintenance request due dates by using the maintenance cycle
defined on the related equipment records.
        AggregateResult[] results = [SELECT Maintenance_Request__c,
                MIN(Equipment__r.Maintenance_Cycle__c)cycle
                FROM Equipment_Maintenance_Item__c
                WHERE Maintenance_Request__c IN :ValidIds GROUP BY
Maintenance_Request__c];

        for (AggregateResult ar : results){

```

```

        maintenanceCycles.put((Id) ar.get('Maintenance_Request__c'), (Decimal)
ar.get('cycle'));
    }

```

```

List<Case> newCases = new List<Case>();
for(Case cc : closedCases.values()){
    Case nc = new Case (
        ParentId = cc.Id,
        Status = 'New',
        Subject = 'Routine Maintenance',
        Type = 'Routine Maintenance',
        Vehicle__c = cc.Vehicle__c,
        Equipment__c =cc.Equipment__c,
        Origin = 'Web',
        Date_Reported__c = Date.Today()
    );

```

```

        //If multiple pieces of equipment are used in the maintenance request,
        //define the due date by applying the shortest maintenance cycle to today's
date.

```

```

        If (maintenanceCycles.containsKey(cc.Id)){
            nc.Date_Due__c = Date.today().addDays((Integer)
maintenanceCycles.get(cc.Id));
        } else {
            nc.Date_Due__c = Date.today().addDays((Integer)
cc.Equipment__r.maintenance_Cycle__c);
        }

```

```

        newCases.add(nc);
    }

```

```

insert newCases;

```

```

List<Equipment_Maintenance_Item__c> clonedList = new
List<Equipment_Maintenance_Item__c>();
for (Case nc : newCases){
    for (Equipment_Maintenance_Item__c clonedListItem :

```

```

closedCases.get(nc.ParentId).Equipment_Maintenance_Items__r){
    Equipment_Maintenance_Item__c item = clonedListItem.clone();
    item.Maintenance_Request__c = nc.Id;
    clonedList.add(item);
}
}
insert clonedList;
}
}
}

```

3.Synchronize Salesforce data with an external system

Code for WarehouseCalloutService

```

public with sharing class WarehouseCalloutService implements Queueable {
    private static final String WAREHOUSE_URL = 'https://th-superbadge-
apex.herokuapp.com/equipment';

```

//Write a class that makes a REST callout to an external warehouse system to get a list of equipment that needs to be updated.

//The callout's JSON response returns the equipment records that you upsert in Salesforce.

```

@future(callout=true)
public static void runWarehouseEquipmentSync(){
    System.debug('go into runWarehouseEquipmentSync');
    Http http = new Http();
    HttpRequest request = new HttpRequest();

    request.setEndpoint(WAREHOUSE_URL);
    request.setMethod('GET');
    HttpResponse response = http.send(request);

    List<Product2> product2List = new List<Product2>();
    System.debug(response.getStatusCode());
    if (response.getStatusCode() == 200){

```



```

        List<Object> jsonResponse =
(List<Object>)JSON.deserializeUntyped(response.getBody());
        System.debug(response.getBody());

        //class maps the following fields:
        //warehouse SKU will be external ID for identifying which equipment records to
update within Salesforce
        for (Object jR : jsonResponse){
            Map<String,Object> mapJson = (Map<String,Object>)jR;
            Product2 product2 = new Product2();
            //replacement part (always true),
            product2.Replacement_Part__c = (Boolean) mapJson.get('replacement');
            //cost
            product2.Cost__c = (Integer) mapJson.get('cost');
            //current inventory
            product2.Current_Inventory__c = (Double) mapJson.get('quantity');
            //lifespan
            product2.Lifespan_Months__c = (Integer) mapJson.get('lifespan');
            //maintenance cycle
            product2.Maintenance_Cycle__c = (Integer)
mapJson.get('maintenanceperiod');
            //warehouse SKU
            product2.Warehouse_SKU__c = (String) mapJson.get('sku');

            product2.Name = (String) mapJson.get('name');
            product2.ProductCode = (String) mapJson.get('_id');
            product2List.add(product2);
        }

        if (product2List.size() > 0){
            upsert product2List;
            System.debug('Your equipment was synced with the warehouse one');
        }
    }
}

public static void execute (QueueableContext context){

```

```

        System.debug('start runWarehouseEquipmentSync');
        runWarehouseEquipmentSync();
        System.debug('end runWarehouseEquipmentSync');
    }
}

```

4.Schedule Synchronization

Code for WarehouseSyncSchedule

```

global with sharing class WarehouseSyncSchedule implements Schedulable{
    global void execute(SchedulableContext ctx){
        System.enqueueJob(new WarehouseCalloutService());
    }
}

```

5.Test automation logic

Code for MaintenanceRequest

```

trigger MaintenanceRequest on Case (before update, after update) {
    if(Trigger.isUpdate && Trigger.isAfter){
        MaintenanceRequestHelper.updateWorkOrders(Trigger.New, Trigger.OldMap);
    }
}

```

Code for MaintenanceRequestHelper

```

public with sharing class MaintenanceRequestHelper {
    public static void updateworkOrders(List<Case> updWorkOrders, Map<Id,Case>
nonUpdCaseMap) {
        Set<Id> validIds = new Set<Id>();
        For (Case c : updWorkOrders){
            if (nonUpdCaseMap.get(c.Id).Status != 'Closed' && c.Status == 'Closed'){
                if (c.Type == 'Repair' || c.Type == 'Routine Maintenance'){
                    validIds.add(c.Id);
                }
            }
        }
    }
}

```

```

    }
  }
}

```

//When an existing maintenance request of type Repair or Routine Maintenance is closed,

//create a new maintenance request for a future routine checkup.

```
if (!validIds.isEmpty()){
```

```
    Map<Id,Case> closedCases = new Map<Id,Case>([SELECT Id, Vehicle__c,
Equipment__c, Equipment__r.Maintenance_Cycle__c,
```

```
                                (SELECT Id,Equipment__c,Quantity__c FROM
Equipment_Maintenance_Items__r)
```

```
                                FROM Case WHERE Id IN :validIds]);
```

```
    Map<Id,Decimal> maintenanceCycles = new Map<ID,Decimal>();
```

//calculate the maintenance request due dates by using the maintenance cycle defined on the related equipment records.

```
    AggregateResult[] results = [SELECT Maintenance_Request__c,
```

```
                                MIN(Equipment__r.Maintenance_Cycle__c)cycle
```

```
                                FROM Equipment_Maintenance_Item__c
```

```
                                WHERE Maintenance_Request__c IN :ValidIds GROUP BY
Maintenance_Request__c];
```

```
    for (AggregateResult ar : results){
```

```
        maintenanceCycles.put((Id) ar.get('Maintenance_Request__c'), (Decimal)
ar.get('cycle'));
    }
```

```
List<Case> newCases = new List<Case>();
```

```
for(Case cc : closedCases.values()){
```

```
    Case nc = new Case (
```

```
        ParentId = cc.Id,
```

```
        Status = 'New',
```

```
        Subject = 'Routine Maintenance',
```

```
        Type = 'Routine Maintenance',
```

```
        Vehicle__c = cc.Vehicle__c,
```

```
        Equipment__c =cc.Equipment__c,
```

```

        Origin = 'Web',
        Date_Reported__c = Date.Today()
    );

    //If multiple pieces of equipment are used in the maintenance request,
    //define the due date by applying the shortest maintenance cycle to today's
date.
    //If (maintenanceCycles.containsKey(cc.Id)){
        nc.Date_Due__c = Date.today().addDays((Integer)
maintenanceCycles.get(cc.Id));
    //} else {
    //    nc.Date_Due__c = Date.today().addDays((Integer)
cc.Equipment__r.maintenance_Cycle__c);
    //}

    newCases.add(nc);
}

insert newCases;

List<Equipment_Maintenance_Item__c> clonedList = new
List<Equipment_Maintenance_Item__c>();
for (Case nc : newCases){
    for (Equipment_Maintenance_Item__c clonedListItem :
closedCases.get(nc.ParentId).Equipment_Maintenance_Items__r){
        Equipment_Maintenance_Item__c item = clonedListItem.clone();
        item.Maintenance_Request__c = nc.Id;
        clonedList.add(item);
    }
}
insert clonedList;
}
}
}

```

Code for MaintenanceRequestHelperTest

@isTest

public with sharing class MaintenanceRequestHelperTest {

 // createVehicle

 private static Vehicle__c createVehicle(){

 Vehicle__c vehicle = new Vehicle__C(name = 'Testing Vehicle');

 return vehicle;

 }

 // createEquipment

 private static Product2 createEquipment(){

 product2 equipment = new product2(name = 'Testing equipment',

 lifespan_months__c = 10,

 maintenance_cycle__c = 10,

 replacement_part__c = true);

 return equipment;

 }

 // createMaintenanceRequest

 private static Case createMaintenanceRequest(id vehicleId, id equipmentId){

 case cse = new case(Type='Repair',

 Status='New',

 Origin='Web',

 Subject='Testing subject',

 Equipment__c=equipmentId,

 Vehicle__c=vehicleId);

 return cse;

 }

 // createEquipmentMaintenanceItem

 private static Equipment_Maintenance_Item__c createEquipmentMaintenanceItem(id equipmentId, id requestId){

 Equipment_Maintenance_Item__c equipmentMaintenanceItem = new
Equipment_Maintenance_Item__c(

 Equipment__c = equipmentId,

 Maintenance_Request__c = requestId);

 return equipmentMaintenanceItem;

```
}
```

```
@isTest
```

```
private static void testPositive(){
```

```
    Vehicle__c vehicle = createVehicle();
```

```
    insert vehicle;
```

```
    id vehicleId = vehicle.Id;
```

```
    Product2 equipment = createEquipment();
```

```
    insert equipment;
```

```
    id equipmentId = equipment.Id;
```

```
    case createdCase = createMaintenanceRequest(vehicleId,equipmentId);
```

```
    insert createdCase;
```

```
    Equipment_Maintenance_Item__c equipmentMaintenanceItem =  
createEquipmentMaintenanceItem(equipmentId,createdCase.id);
```

```
    insert equipmentMaintenanceItem;
```

```
    test.startTest();
```

```
    createdCase.status = 'Closed';
```

```
    update createdCase;
```

```
    test.stopTest();
```

```
Case newCase = [Select id,
```

```
    subject,
```

```
    type,
```

```
    Equipment__c,
```

```
    Date_Reported__c,
```

```
    Vehicle__c,
```

```
    Date_Due__c
```

```
from case
```

```
where status ='New'];
```

```
Equipment_Maintenance_Item__c workPart = [select id
```

```
    from Equipment_Maintenance_Item__c
```

```
    where Maintenance_Request__c =:newCase.Id];
```



```
where Maintenance_Request__c = :createdCase.Id];
```

```
system.assert(equipmentMaintenanceltem != null);  
system.assert(allCase.size() == 1);  
}
```

```
@isTest
```

```
private static void testBulk(){  
    list<Vehicle__C> vehicleList = new list<Vehicle__C>();  
    list<Product2> equipmentList = new list<Product2>();  
    list<Equipment_Maintenance_Item__c> equipmentMaintenanceltemList = new  
list<Equipment_Maintenance_Item__c>();  
    list<case> caseList = new list<case>();  
    list<id> oldCaseIds = new list<id>();  
  
    for(integer i = 0; i < 300; i++){  
        vehicleList.add(createVehicle());  
        equipmentList.add(createEquipment());  
    }  
    insert vehicleList;  
    insert equipmentList;  
  
    for(integer i = 0; i < 300; i++){  
        caseList.add(createMaintenanceRequest(vehicleList.get(i).id,  
equipmentList.get(i).id));  
    }  
    insert caseList;  
  
    for(integer i = 0; i < 300; i++){  
  
equipmentMaintenanceltemList.add(createEquipmentMaintenanceltem(equipmentList.  
get(i).id, caseList.get(i).id));  
    }  
    insert equipmentMaintenanceltemList;  
  
    test.startTest();  
    for(case cs : caseList){
```



```

        cs.Status = 'Closed';
        oldCaseIds.add(cs.Id);
    }
    update caseList;
    test.stopTest();

    list<case> newCase = [select id
                        from case
                        where status = 'New'];

    list<Equipment_Maintenance_Item__c> workParts = [select id
                                                    from Equipment_Maintenance_Item__c
                                                    where Maintenance_Request__c in: oldCaseIds];

    system.assert(newCase.size() == 300);

    list<case> allCase = [select id from case];
    system.assert(allCase.size() == 600);
}
}

```

6. Test callout logic

Code for WarehouseCalloutService

```

public with sharing class WarehouseCalloutService implements Queueable {
    private static final String WAREHOUSE_URL = 'https://th-superbadge-
    apex.herokuapp.com/equipment';

```

//Write a class that makes a REST callout to an external warehouse system to get a list of equipment that needs to be updated.

//The callout's JSON response returns the equipment records that you upsert in Salesforce.

```

@future(callout=true)

```

```

public static void runWarehouseEquipmentSync(){
    System.debug('go into runWarehouseEquipmentSync');
    Http http = new Http();
    HttpRequest request = new HttpRequest();

    request.setEndpoint(WAREHOUSE_URL);
    request.setMethod('GET');
    HttpResponse response = http.send(request);

    List<Product2> product2List = new List<Product2>();
    System.debug(response.getStatusCode());
    if (response.getStatusCode() == 200){
        List<Object> jsonResponse =
(List<Object>)JSON.deserializeUntyped(response.getBody());
        System.debug(response.getBody());

        //class maps the following fields:
        //warehouse SKU will be external ID for identifying which equipment records to
update within Salesforce
        for (Object jR : jsonResponse){
            Map<String,Object> mapJson = (Map<String,Object>)jR;
            Product2 product2 = new Product2();
            //replacement part (always true),
            product2.Replacement_Part__c = (Boolean) mapJson.get('replacement');
            //cost
            product2.Cost__c = (Integer) mapJson.get('cost');
            //current inventory
            product2.Current_Inventory__c = (Double) mapJson.get('quantity');
            //lifespan
            product2.Lifespan_Months__c = (Integer) mapJson.get('lifespan');
            //maintenance cycle
            product2.Maintenance_Cycle__c = (Integer)
mapJson.get('maintenanceperiod');
            //warehouse SKU
            product2.Warehouse_SKU__c = (String) mapJson.get('sku');

            product2.Name = (String) mapJson.get('name');

```

```

        product2.ProductCode = (String) mapJson.get('_id');
        product2List.add(product2);
    }

    if (product2List.size() > 0){
        upsert product2List;
        System.debug('Your equipment was synced with the warehouse one');
    }
}

}

public static void execute (QueueableContext context){
    System.debug('start runWarehouseEquipmentSync');
    runWarehouseEquipmentSync();
    System.debug('end runWarehouseEquipmentSync');
}

}

```

Code for WarehouseCalloutServiceMock

```

@Test
global class WarehouseCalloutServiceMock implements HttpCalloutMock {
    // implement http mock callout
    global static HttpResponse respond(HttpRequest request) {

        HttpResponse response = new HttpResponse();
        response.setHeader('Content-Type', 'application/json');

        response.setBody('["_id":"55d66226726b611100aaf741","replacement":false,"quantity":5
        ,"name":"Generator 1000
        kW","maintenanceperiod":365,"lifespan":120,"cost":5000,"sku":"100003"],{"_id":"55d66226
        726b611100aaf742","replacement":true,"quantity":183,"name":"Cooling
        Fan","maintenanceperiod":0,"lifespan":0,"cost":300,"sku":"100004"},{"_id":"55d66226726b6
        11100aaf743","replacement":true,"quantity":143,"name":"Fuse
        20A","maintenanceperiod":0,"lifespan":0,"cost":22,"sku":"100005"}]');
        response.setStatusCode(200);
    }
}

```

```

        return response;
    }
}

```

Code for WarehouseCalloutServiceTest

```

@Test
private class WarehouseCalloutServiceTest {
    // implement your mock callout test here
    @Test
    static void testWarehouseCallout() {
        test.startTest();
        test.setMock(HttpCalloutMock.class, new WarehouseCalloutServiceMock());
        WarehouseCalloutService.execute(null);
        test.stopTest();

        List<Product2> product2List = new List<Product2>();
        product2List = [SELECT ProductCode FROM Product2];

        System.assertEquals(3, product2List.size());
        System.assertEquals('55d66226726b611100aaf741',
product2List.get(0).ProductCode);
        System.assertEquals('55d66226726b611100aaf742',
product2List.get(1).ProductCode);
        System.assertEquals('55d66226726b611100aaf743',
product2List.get(2).ProductCode);
    }
}

```

7. Test scheduling logic

Code for WarehouseSyncSchedule

```

global with sharing class WarehouseSyncSchedule implements Schedulable {
    // implement scheduled code here
    global void execute (SchedulableContext ctx){
        System.enqueueJob(new WarehouseCalloutService());
    }
}

```

```
}  
}
```

Code for WarehouseServiceMock

```
@isTest  
global class WarehouseCalloutServiceMock implements HttpCalloutMock {  
    // implement http mock callout  
    global static HttpResponse respond(HttpRequest request) {  
  
        HttpResponse response = new HttpResponse();  
        response.setHeader('Content-Type', 'application/json');  
  
        response.setBody(['{"_id":"55d66226726b611100aaf741","replacement":false,"quantity":5  
,"name":"Generator 1000  
kW","maintenanceperiod":365,"lifespan":120,"cost":5000,"sku":"100003"},{"_id":"55d66226  
726b611100aaf742","replacement":true,"quantity":183,"name":"Cooling  
Fan","maintenanceperiod":0,"lifespan":0,"cost":300,"sku":"100004"},{"_id":"55d66226726b6  
11100aaf743","replacement":true,"quantity":143,"name":"Fuse  
20A","maintenanceperiod":0,"lifespan":0,"cost":22,"sku":"100005"}]]);  
        response.setStatusCode(200);  
  
        return response;  
    }  
}
```

Code for WarehouseSyncScheduleTest

```
@isTest  
public with sharing class WarehouseSyncScheduleTest {  
    // implement scheduled code here  
    //  
    @isTest static void test() {  
        String scheduleTime = '00 00 00 * * ? *';  
        Test.startTest();  
        Test.setMock(HttpCalloutMock.class, new WarehouseCalloutServiceMock());  
    }  
}
```

```
String jobId = System.schedule('Warehouse Time to Schedule to test',
scheduleTime, new WarehouseSyncSchedule());
CronTrigger c = [SELECT State FROM CronTrigger WHERE Id =: jobId];
System.assertEquals('WAITING', String.valueOf(c.State), 'JobId does not match');

Test.stopTest();
}
}
```