SOFTWARE TEST PLAN (SDD)

ANTHROCLOUD

Software Modernization for Cloud-based Pediatric Anthropometry

December 4, 2019

Version 1

COT 6931 Dusty Wright

Change History

Version	Date	Author	Changes
1.0	December 4, 2019	Dusty Wright	Initial Document

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1 Introduction

1.1 Purpose

The purpose of this document is to record and track the testing effort for the AnthroCloud software solution. Stakeholders, testers, and developers are the intended audience for this document. This document captures and constructs plans for each level of testing.

1.2 Objectives

The objective is to complete unit tests, integration testing, system tests, and end-to-end testing during the schedule time allotted. The author is the resource. The schedule is from November 11, 2019 to December 4, 2019. The approach is to conduct unit and integration testing throughout the project with a documented final testing effort at the conclusion of the project. The requirements traceability matrix is in Appendix A. The scope of testing effort encompasses unit tests, integration tests, system tests, and manual end-to-end testing.

1.3 Strategy

The strategy is to use automated testing for unit and integration tests, manual testing for the user interface, and a checklist for systems testing. Unit tests are conducted first. The integration testing is conducted next. System testing will then be conducted. The end-to-end testing will be executed last. Pass or fail will be recorded for each tested item. A Requirements Traceability Matrix will be included in Appendix A. All test plans may contribute to the Requirements Traceability Matrix.

Unit tests are automated tests used to test individual functions to meet design. Integration tests are automated tests occurring through multiple software layers using stubbed or actual data. System testing ensure components meet the outline requirements. The manual testing effort tests the application features from start to finish using the user interface. This document follows the format of the Test Plan guide made available from the Centers for Disease Control and Prevention (CDC) UP Templates for standardized project management (CDC, 2017).

1.4 References

Centers for Disease Control and Prevention (CDC). (2017). Test Plan. Retrieved November 18, 2019, from https://www2a.cdc.gov/cdcup/library/templates/default.htm

1.5 Definitions, acronyms, abbreviations

API	Application Programming Interface	A publicly available web-based application programming interface that accesses functions to returns data.
BMI	Body mass index-for-age (BMI-for-age)	Body mass index (BMI) is a height and weight body fat measure.
CDC	Center for Disease Control and Prevention	The national public health institute in the United States.
centile	Percentile	‘Centile’ is a short term for ‘percentile’.
HCFA	Head circumference-for-age	Indictor for head circumference percentile 3 through 60 months.
LFA	Length-for-age	Indicator for length percentile 0 through 24 months.
LHA	Height-for-age	Indicator for height percentile 24 through 60 months.

MIS	Management Information System	A computerized information system used for decision-making in the WIC program.
MUAC	Mid Upper Arm Circumference	The circumference of the left upper arm.
REST	Representational State Transfer	A set of architectural constraints for web services that define standards for communication.
SD	Standard Deviation	The variation of a set of values.
SSF	Subscapular skinfold-for-age	Indicator for body fat measuring shoulder skinfold thickness percentile.
TSF	Triceps skinfold-for-age	Indicator for body fat measuring triceps skinfold thickness percentile.
WFA	Weight-for-age	Indicator to determine healthy weight for age.
WFL	Weight-for-length	Indicator to determine healthy weight for length 0 through 24 months.
WFH	Weight-for-height	Indicator to determine healthy weight for height 24 through 60 months.
WHO	World Health Organization	A United Nations agency concerned with international public health.
WIC	Women, Infants, & Children	A federally funded nutrition program for women, infants, and children.

2 Unit Testing

The automated unit tests created for this project access classes directly. The purpose is to test the smallest piece of verifiable software in the application.

2.1 Test Risks / Issues

Test item availability of Age, BMI, and Statistics functions classes are required. Age is necessary to calculate seven 'for-age' Z-scores and Percentiles indicators. BMI is necessary for BMI-for-age calculation and charting. Statistics are necessary for all Z-score and Percentile calculation for 10 indicators.

2.2 Items Tested /Items Not Tested

Age, BMI, and Statistics functions do not need to access the database. Mocks, fakes, or stubs are not necessary to calculate results. Chart functions will not be tested as they are data dependent. All unit tests are critical.

	Test Name					
#	**Unit of Work**	**State Under Test**	**Expected Behavior**	**Description**	**Test Date**	**Pass/Fail**
UT-1	Age	Days	Calculate	Tests equality comparison an age object's total days calculation.	11/19/19	Pass
UT-2	Age	Months	Calculate	Tests equality comparison an age object's total months calculation.	11/19/19	Pass

UT-3	Age	Year	Calculate	Tests equality comparison an age object's total years calculation.	11/19/19	Pass
UT-4	Age	String	WriteString	Tests equality comparison an age object's string output.	11/19/19	Pass
UT-5	BMI	TwoUnderRecumbent	QuotientIncreases	Tests equality comparison of BMI using unmodified length for a child under 2 recumbently	11/19/19	Pass
UT-6	BMI	TwoUnderStanding	QuotientDecreases	Tests equality comparison of BMI using +.7 length for a child under 2 standing	11/19/19	Pass
UT-7	BMI	TwoOverRecumbent	QuotientIncreases	Tests equality comparison of BMI using -.7 length for a child over 2 recumbently	11/19/19	Pass
UT-8	BMI	TwoOverStanding	QuotientDecreases	Tests equality comparison of BMI using unmodified length for a child over 2 standing	11/19/19	Pass
UT-9	Stats	WFL_Pcentile	Calculate	Tests Weight-for-length percentile calculation.	11/19/19	Pass
UT-10	Stats	WFL_Zscore	Calculate	Tests Weight-for-length z-score calculation.	11/19/19	Pass
UT-11	Stats	WFH_Pcentile	Calculate	Tests Weight-for-height percentile calculation.	11/19/19	Pass
UT-12	Stats	WFH_Zscore	Calculate	Tests Weight-for-height z-score calculation.	11/19/19	Pass
UT-13	Stats	WFA_Pcentile	Calculate	Tests Weight-for-age z-score calculation.	11/19/19	Pass
UT-14	Stats	WFA_Zscore	Calculate	Tests Weight-for-age percentile calculation.	11/19/19	Pass
UT-15	Stats	LFA_Pcentile	Calculate	Tests Length-for-age z-score calculation.	11/19/19	Pass
UT-16	Stats	LFA_Zscore	Calculate	Tests Length-for-age percentile calculation.	11/19/19	Pass
UT-17	Stats	HFA_Pcentile	Calculate	Tests Height-for-age percentile calculation.	11/19/19	Pass
UT-18	Stats	HFA_Zscore	Calculate	Tests Height-for-age z-score calculation.	11/19/19	Pass
UT-19	Stats	BFA_Pcentile	Calculate	Tests BodyMassIndexForAge percentile calculation.	11/19/19	Pass
UT-20	Stats	BFA_Zscore	Calculate	Tests BodyMassIndexForAge z-score calculation.	11/19/19	Pass

UT-21	Stats	HCFA_Pcentile	Calculate	Tests HeadCircumferenceForAge percentile calculation.	11/19/19	Pass
UT-22	Stats	HCFA_Zscore	Calculate	Tests HeadCircumferenceForAge z-score calculation.	11/19/19	Pass
UT-23	Stats	MUAC_Pcentile	Calculate	Tests ArmCircumferenceForAge percentile calculation.	11/19/19	Pass
UT-24	Stats	MUAC_Zscore	Calculate	Tests ArmCircumferenceForAge z-score calculation.	11/19/19	Pass
UT-25	Stats	TSF_Pcentile	Calculate	Tests TricepsSkinfoldForAge percentile calculation.	11/19/19	Pass
UT-26	Stats	TSF_Zscore	Calculate	Tests TricepsSkinfoldForAge z-score calculation.	11/19/19	Pass
UT-27	Stats	SSF_Pcentile	Calculate	Tests SubscapularSkinfoldForAge percentile calculation.	11/19/19	Pass
UT-28	Stats	SSF_Zscore	Calculate	Tests SubscapularSkinfoldForAge z-score calculation.	11/19/19	Pass
UT-29	Stats	ALL	Tuples	Tests percentile and zscore range for all 10.	11/19/19	Pass

Table 1 - Unit Tests

2.3 Test Approach(s)

Automated unit tests will be executed from the development environment. Classes can be tested upon completion. Test results can be verified using the WHO Anthro desktop calculator. The AnthroCloud test project uses xUnit as the test library. Test attributes [Fact] and [Theory] are available. The [Fact] attribute indicates a test to be executed by the test runner in the development environment. The [Theory] attribute indicates a test that can have different input arguments. The [InLineData] attribute specifies values for input. The xUnit library was specifically chosen for its ability to load data scenarios into a test method. See Table 1 for planned tests.

2.4 Test Regulatory / Mandate Criteria

Test results can be verified using the WHO Anthro desktop calculator. All testing levels may support items found in the Requirements Traceability Matrix. See appendix A for Requirements Traceability Matrix.

2.5 Test Pass / Fail Criteria

A passing test is green lit meeting the asserted verified conditions; otherwise, a failing test. A failing test is red lit failing the asserted verified conditions. See sample passing criteria below:

- Equal verifies that two objects are equal using a default comparer. For example, the 'actual' BMI for an infant weighing 9kg measuring 73cm is 16.9 passing the test 'expected' default comparer 16.9.
- InRange verifies that a value is within a given range. For example, a correctly calculated percentile will range between 0 and 100 passing asserted test criteria.

2.6 Test Entry / Exit Criteria

The Age, BMI, and Statistics classes must be completed to begin unit testing. Unit testing stops when all Table 1 tests pass.

2.7 Test Deliverables

A screenshot of all unit tests (AnthroCloud.Unit.Tests) successfully passing (green lights). Any defects will be logged in Appendix D – Test Defect Log. See Appendix B – Unit Test Screenshot.

2.8 Test Suspension / Resumption Criteria

Unit testing can be suspended if additional work is necessary to complete either Age, BMI, or Statistics classes. Bug and fix resolution in response to a reported defect will suspend testing. Unit testing can resume once the fix is complete. All tests must pass.

2.9 Test Environment / Staffing / Training Needs

Visual Studio 2019 was used to execute AnthroCloud unit tests. This is a .NET Core project. It is possible to execute "dotnet test" from .NET Core command line interface by specifying xUnit as the driver. Some configuration may be necessary in your environment.

3 Integration Testing

Integration testing combines software modules to test Web API controllers that access data. The data retrieval and calculations for the software are conducted here. The purpose is to simulate web client interactions to validate the system and components.

3.1 Test Risks / Issues

Test item availability of Anthro, Chart, and Stats controller classes are required. The Anthro controller is necessary for BMI and Age functions. The Chart controller is heavily data dependent. The Statistics controller is necessary for Z-score and Percentile calculation of all indicators.

3.2 Items Tested /Items Not Tested

The AnthroController, ChartController, and StatsController classes access data. Integration tests use Web API controllers and are necessary to begin integration testing. Unit test, Systems test, and End-to-End test functions will not be tested. All integration tests are critical.

	Test Name					
#	**Unit of Work**	**State Under Test**	**Expected Behavior**	**Description**	**Test Date**	**Pass/Fail**
IT-1	Age	Days	ShouldReturnDaysString	Tests equality comparison an age object's total days calculation.	11/20/19	Pass

IT-2	Age	Months	ShouldReturnMonthsString	Tests equality comparison an age object's total months calculation.	11/20/19	Pass
IT-3	Age	Year	ShouldReturnYearsString	Tests equality comparison an age object's total years calculation.	11/20/19	Pass
IT-4	Age	String	ShouldReturnYearMonthString	Tests equality comparison an age object's string output.	11/20/19	Pass
IT-5	BMI	Parameters	ShouldReturnBMIString	Tests equality comparison expected value for a BMI object's actual output.	11/20/19	Pass
IT-6	GetBMI	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for BMI chart data given new data point (x,y) when male.	11/20/19	Pass
IT-7	GetBMI	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for BMI chart data given new data point (x,y) when female.	11/20/19	Pass
IT-8	GetHCFA	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for HCFA chart data given new data point (x,y) when male.	11/20/19	Pass
IT-9	GetHCFA	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for HCFA chart data given new data point (x,y) when female.	11/20/19	Pass
IT-10	GetLHFA	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for LHFA chart data given new data point (x,y) when male.	11/20/19	Pass
IT-11	GetLHFA	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for LHFA chart data given new data point (x,y) when female.	11/20/19	Pass

IT-12	GetMUAC	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for MUAC chart data given new data point (x,y) when male.	11/20/19	Pass
IT-13	GetMUAC	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for MUAC chart data given new data point (x,y) when female.	11/20/19	Pass
IT-14	GetSSFA	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for SSFA chart data given new data point (x,y) when male.	11/20/19	Pass
IT-15	GetSSFA	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for SSFA chart data given new data point (x,y) when female.	11/20/19	Pass
IT-16	GetTSFA	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for TSFA chart data given new data point (x,y) when male.	11/20/19	Pass
IT-17	GetTSFA	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for TSFA chart data given new data point (x,y) when female.	11/20/19	Pass
IT-18	GetWFA	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for WFA chart data given new data point (x,y) when male.	11/20/19	Pass
IT-19	GetWFA	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for WFA chart data given new data point (x,y) when female.	11/20/19	Pass
IT-20	GetWFH	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for WFH chart data given new data point (x,y) when male.	11/20/19	Pass
IT-21	GetWFH	MaleNewXNewY	ShouldReturnInterpolated	Tests chart controller logic for WFH chart	11/20/19	Pass

				data given new interpolated data point (x,y) when male.		
IT-22	GetWFH	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for WFH chart data given new data point (x,y) when female.	11/20/19	Pass
IT-23	GetWFH	FemaleNewXNewY	ShouldReturnInterpolated	Tests chart controller logic for WFH chart data given new interpolated data point (x,y) when male.	11/20/19	Pass
IT-24	GetWFL	MaleNewXNewY	ShouldReturnAllMale	Tests chart controller logic for WFL chart data given new data point (x,y) when male.	11/20/19	Pass
IT-25	GetWFL	MaleNewXNewY	ShouldReturnInterpolated	Tests chart controller logic for WFL chart data given new interpolated data point (x,y) when male.	11/20/19	Pass
IT-26	GetWFL	FemaleNewXNewY	ShouldReturnAllFemale	Tests chart controller logic for WFL chart data given new data point (x,y) when female.	11/20/19	Pass
IT-27	GetWFL	FemaleNewXNewY	ShouldReturnInterpolated	Tests chart controller logic for WFL chart data given new interpolated data point (x,y) when male.	11/20/19	Pass
IT-28	GetScores	PairValues	ShouldReturnTuples	Tests InRange comparison theory where percentile and z-score numeric ranges are expected.	11/20/19	Pass
IT-29	GetScores	ColorCoding	ShouldReturnZscoreSeverity	Tests equality comparison theory where expected chart line color code is assigned from IT-	11/20/19	Pass

				percentile and z-score numeric range.		

Table 2 – Integration Tests

3.3 Test Approach(s)

Automated integration tests will be executed from the development environment. Targeted controller classes can be tested upon completion. Test results can be verified using the WHO Anthro desktop calculator. The AnthroCloud test project uses xUnit as the test library. Test attributes [Fact] and [Theory] are available. The [Fact] attribute indicates a test to be executed by the test runner in the development environment. The [Theory] attribute indicates a test that can have different input arguments. The [InLineData] attribute specifies values for input. The xUnit library was specifically chosen for its ability to load data scenarios into a test method. See Table 2 for planned tests.

3.4 Test Regulatory / Mandate Criteria

Test results can be verified using the WHO Anthro desktop calculator. All testing levels may support items found in the Requirements Traceability Matrix. See appendix A for Requirements Traceability Matrix.

3.5 Test Pass / Fail Criteria

A passing test is green lit meeting the asserted verified conditions; otherwise, a failing test. A failing test is red lit failing the asserted verified conditions. See sample passing criteria below:

- Equal verifies that two objects are equal using a default comparer. For example, the 'actual' age in years value is obtained from the Anthro controller using a 2019 visit date and a 2016 birth date as parameters, then compared to the 'expected' value of 3.
- InRange verifies that a value is within a given range. For example, a correctly calculated will range between 0 and 100 passing asserted test criteria.

3.6 Test Entry / Exit Criteria

The AnthroController, ChartController, and StatsController classes must be completed to begin integration testing. Integration testing stops when all Table 2 tests pass.

3.7 Test Deliverables

A screenshot of all integration tests (AnthroCloud.Integration.Tests) successfully passing (green lights). Any defects will be logged in Appendix D – Test Defect Log. See Appendix C – Integration Tests Screenshot.

3.8 Test Suspension / Resumption Criteria

Integration testing can be suspended if additional work is necessary to complete either Anthro, Chart, or Statistics controller classes. Bug and fix resolution in response to a reported defect will suspend testing. Integration testing can resume once the fix is complete. All tests must pass.

3.9 Test Environment / Staffing / Training Needs

Visual Studio 2019 was used to execute AnthroCloud integration tests. This is a .NET Core project. It is possible to execute "dotnet test" from .NET Core command line interface by specifying xUnit as the driver. Some configuration may be necessary in your environment.

4 System Testing

System testing verifies high level system components and deliverables comply with requirements. The purpose is to test a complete and fully integrated software product.

4.1 Test risks / issues

System testing assumes integration testing has passed components. The focus is on detecting issues between integrated components. The possible issues arising from these tests will be discovering defects within components, their integration, and the whole system. Some tests may occur outside the system.

4.2 Items to be tested / not tested

The AnthroCloud system is to be tested. The Azure platform and components are verified. The external repository is verified. The development environment is verified. Performance is verified. Any remaining requirement on the Requirements Traceability Matrix are to be tested. Automated tests and end-to-end tests will not be tested.

ID	Items to Test	Test Description	Test Date	Pass/Fail
ST-1	HI-1: The solution shall use the Azure cloud platform.	Use the student account to login into Azure Portal and verify the AnthroCloudResourceGroup consists of the AnthroCloud App Service, AnthroCloudAPI App Service, AnthroCloud SQL Server, AnthroCloudSQL Database instance, and AnthroCloudAPI service plan. Also, the subscription type will be called Azure for Students.	11/24/2019	Pass
ST-2	HI-2: The solution shall use an Azure App Service.	Access the Azure Portal with student account to verify existing AnthroCloud App Service and AnthroCloudAPI App Service are configured under App Service Plan AnthroCloudAPI (F1: Free).	11/24/2019	Pass
ST-3	HI-3: The solution shall use an Azure database.	Access the Azure Portal with student account to verify existing AnthroCloudSQL Database instance is configured under the Basic pricing tier.	11/24/2019	Pass
ST-4	SI-1: The solution shall use a Visual Studio integrated development environment.	AnthroCloud.sln exists in the root of the cloned GitHub source code.	11/24/2019	Pass
ST-5	SI-2: The solution shall use an Azure subscription.	Access the Azure Portal with student account to verify existing Academic Azure Sponsorship and Azure for Students remaining balance. The directory should be University of West Florida. The status should be	11/24/2019	Pass

		active. $62 of 100 balance currently remaining.		
ST-6	SI-3: The solution shall use a GitHub repository.	Verify repository at https://github.com/rdw28/AnthroCloud	11/24/2019	Pass

ST-7	CI-1: The service shall use a RESTful API for HTTP requests.	Use Postman to execute GET using https://anthrocloudapi.azurewebsites.net/api/Stats/WeightForHeight/9.00/73.00/Female to obtain the following JSON response body:
		{
		"item1": 0.12,
		"item2": 54.8
		}
			11/24/2019	Pass

ST-8	SF-8: The database shall store WHO Child Growth Standard data.	Use Postman to execute GET using https://anthrocloudapi.azurewebsites.net/api/chart/BFA/1/12/16.9 to obtain the following JSON response body:
		{
		"month": 0,
		"sex": 1,
		"l": -0.3053,
		"m": 13.4069,
		"s": 0.0956,
		"sd3neg": 10.2,
		"sd2neg": 11.1,
		"sd1neg": 12.2,
		"sd0": 13.4,
		"sd1": 14.8,
		"sd2": 16.3,
		"sd3": 18.1,
		"p3": 11.3,
		"p15": 12.2,
		"p50": 13.4,
		"p85": 14.8,
		"p97": 16.1,
		"score": null,
		"mark": null,
		"marktext": null
		}
			11/24/2019	Pass

ST-9	PER-1: The service shall not exceed 5 seconds for the longest running call.	Data entry form calculation and chart retrieval cannot exceed 5 seconds.	11/22/2019	Pass
ST-10	DC-1: All HTML code shall conform to HTML 5.0 standard.	Eliminate all Errors on using W3C validator, https://validator.w3.org/.	11/24/2019	Pass
ST-11	MNT-1: The solution shall use an application, service, and database.	Use the student account to login into Azure Portal and verify the AnthroCloudResourceGroup consists of the AnthroCloud App Service, AnthroCloudAPI App Service, AnthroCloud SQL Server, AnthroCloudSQL Database instance, and AnthroCloudAPI service plan.	11/24/2019	Pass

		Also, the subscription type will be called Azure for Students.		
ST-12	MNT-2: The solution shall be architected using layers.	Build the solution from the cloned repository. Open the dependency layer diagram found in AnthroCloud.Architecture project. No errors will appear.	11/24/2019	Pass
ST-13	PRT-1: The solution shall use the .NET Core framework.	Verify the following target attribute in both AnthroCloud.UI.Web.csproj and AnthroCloud.API.csproj files: <TargetFramework>netcoreapp3.0</TargetFramework>	11/24/2019	Pass
ST-14	PRT-2: PRT-2: The solution shall contain a Dockerfile.	Verify a file named Dockerfile in the AnthroCloud.UI.Web and AnthroCloud.API projects.	11/24/2019	Pass

Table 3 – System Tests

4.3 Test Approach(s)

The test approach is to verify working components in a complete system. System testing is a black box testing technique where the observer is typically external to the development effort. The focus is on functionality, interoperability, and performance. The testing effort evaluate compliance against specified requirements. See Table 3 for planned tests.

4.4 Test Regulatory / Mandate Criteria

All testing levels may support items found in the Requirements Traceability Matrix. See appendix A for Requirements Traceability Matrix.

4.5 Test Pass / Fail Criteria

A passing test meets the asserted verified conditions; otherwise, a failing test. A failing test does not meet the asserted verified conditions. See sample passing criteria below:

- Accessed Azure Portal with student account to verify existing AnthroCloud Azure App Service configured under App Service Plan AnthroCloudAPI (F1: Free).

4.6 Test Entry / Exit Criteria

System testing can begin once automated testing is complete. The system testing test plan can be exited once all item in Table 3 pass.

4.7 Test Deliverables

Table 3 will be updated. Any defects will be logged in Appendix D – Test Defect Log. The Requirements Traceability Matrix will be updated in Appendix A.

4.8 Test Suspension / Resumption Criteria

System testing can be suspended if additional work is necessary to complete coding. Bug and fix resolution in response to a reported defect will suspend testing. System testing can resume once the fix is complete. All tests must pass.

4.9 Test Environment / Staffing / Training Needs

Azure portal access using a student account is required. Postman is required for external REST/API communication. GIT commands or related software is required to clone a repository from GitHub.

5 End-to-End Testing

End-to-end testing tests the full functionality of the live web application from user interface. The purpose is to test the user interface to validate the system and components.

5.1 Test Risks / Issues

End-to-end tests have more steps and involve more working parts of the system. The possible issues arising from these tests will be isolating the specific area of fault given the layers software involved. These tests will be conducted after the completion of automated and system testing.

5.2 Items Tested /Items Not Tested

The user interface is to be tested. The user interface collects 10 inputs. The user interface displays 43 outputs. All remaining user interface requirements on the Requirements Traceability Matrix are to be tested. System elements will not be tested here.

ID	Items to Test	Test Description	Test Date	Pass/Fail
ET-1	Weight Validation	Test input restriction range 0.9 – 58.0.	11/20/2019	Pass
ET-2	Length/height Validation	Test input restriction range 45.0 – 120.0.	11/20/2019	Pass
ET-3	Head circumference Validation	Test input restriction range 25.0 – 64.0.	11/20/2019	Pass
ET-4	Arm circumference Validation	Test input restriction range 6.0 – 35.0.	11/20/2019	Pass
ET-5	Triceps skinfold Validation	Test input restriction range 1.8 – 40.0.	11/20/2019	Pass
ET-6	Subscapular skinfold Validation	Test input restriction range 1.8 – 40.0.	11/20/2019	Pass
ET-7	Oedema NA	Test output restriction NA for weight indicators when Yes.	11/20/2019	Pass
ET-8	MUAC NA	Test output restriction NA for less than 3 months.	11/20/2019	Pass
ET-9	SSF NA	Test output restriction NA for less than 3 months.	11/22/2019	Pass
ET-10	TSF NA	Test output restriction NA for less than 3 months.	11/22/2019	Pass
ET-11	Measure Type - WFL Under 2 Only (Recumbent)	Test output result WFL display, output result age, & input selection recumbent.	11/22/2019	Pass
ET-12	Measure Type - WFL Over 2 Only (Standing)	Test output result WFH display, output result age, & input selection recumbent.	11/22/2019	Pass

ET-13	BFA Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-14	HCA Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-15	HCA Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-16	LHFA Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-17	MUAC Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-18	SSF Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-19	TSF Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-20	WFA Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-21	WFH Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-22	WFL Color Code x4	Test BFA levels of severity for z-score html background color (Green, Gold, Red, Black).	11/22/2019	Pass
ET-23	Boys BFA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-24	Girls BFA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-25	Boys HCA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-26	Girls HCA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-27	Boys LHFA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-28	Girls LHFA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-29	Boys MUAC Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-30	Girls MUAC Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass

ET-31	Boys SSF Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-32	Girls SSF Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-33	Boys TSF Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-34	Girls TSF Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-35	Boys WFA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-36	Girls WFA Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-37	Boys WFH Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-38	Girls WFH Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-39	Boys WFL Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-40	Girls WFL Chart	Visually compare x-axis and y-axis to real WHO chart.	11/23/2019	Pass
ET-41	Date of Birth	Calendar control sets value.	11/22/2019	Pass
ET-42	Date of Visit	Calendar control sets value.	11/22/2019	Pass
ET-43	Sex	Radio button group allows two choices.	11/22/2019	Pass
ET-44	Displays 9 Z-scores indicators	The user interface displays z-scores for WFL/WFH, WFA, LFA, BFA, HCA, MUAC, TSF, & SSF measurements.	11/22/2019	Pass
ET-45	Displays 9 Percentiles indicators	The user interface displays percentiles for WFL/WFH, WFA, LFA, BFA, HCA, MUAC, TSF, & SSF measurements.	11/22/2019	Pass
ET-46	Displays 2 charts for 9 indicators	The user interface displays charts for WFL/WFH, WFA, LFA, BFA, HCA, MUAC, TSF, & SSF measurements.	11/22/2019	Pass
ET-47	Displays a chart title	The user interface displays a chart title for WFL/WFH, WFA, LFA, BFA, HCA, MUAC, TSF, & SSF measurements.	11/23/2019	Pass
ET-48	Displays a growth standard	The user interface displays a growth standard for WFL/WFH, WFA, LFA, BFA, HCA, MUAC, TSF, & SSF measurements.	11/23/2019	Pass
ET-49	Displays a score	The user interface displays a score for WFL/WFH, WFA, LFA, BFA, HCA, MUAC, TSF, & SSF measurements.	11/22/2019	Pass
ET-50	Displays age correctly	The age calculation of 1 year requires the completion of the full	11/22/2019	Pass

		calendar year. So, 11/22/18 to 11/23/18 is one year.		

Table 4 – End-to-end Tests

5.3 Test Approach(s)

The AnthroCloud Web Application is accessible from a URL subdomain of Azure websites, https://anthrocloud.azurewebsites.net/. A Chrome browser will be used for testing. See Table 4 for planned tests.

5.4 Test Regulatory / Mandate Criteria

Test results can be verified using the WHO Anthro desktop calculator. All testing levels may support items found in the Requirements Traceability Matrix. See Appendix A.

5.5 Test Pass / Fail Criteria

A passing test meets the asserted verified conditions; otherwise, a failing test. A failing test does not meet the asserted verified conditions. See sample passing criteria below:

- A weight-for-length percentile chart displays Black, Red, Gold, and Green color-coding chart line per numeric ranges in comparison to the WHO Anthro desktop application.

5.6 Test Entry / Exit Criteria

End-to-end testing can begin once unit test and integration test plans are complete. The end-to-end testing test plan can be exited once all item in Table 4 pass.

5.7 Test Deliverables

Table 4 will be updated. Any defects will be logged in Appendix D – Test Defect Log. The Requirements Traceability Matrix will be updated in Appendix A.

5.8 Test Suspension / Resumption Criteria

End-to-end testing can be suspended if additional work is necessary to complete coding. Bug and fix resolution in response to a reported defect will suspend testing. End-to-end testing can resume once the fix is complete. All tests must pass.

5.9 Test Environment / Staffing / Training Needs

A Chrome browser is recommended for the best experience.

6 Test Plan Approvals

The undersigned acknowledge they have reviewed the AnthroCloud Test Plan document and agree with the approach it presents. Any changes to this document will be coordinated with and approved by the undersigned or their designated representatives.

Signature: _____

Print Name: _____ Date: _____

Title: _____

Role: _____

Appendix A - Requirements Traceability Matrix

The Requirements Traceability Matrix maps requirements identified in the Software Requirements Specification document to the Software Design Document. Test Cases target this relationship to validate the functionality. Defects found during test are also recorded. The matrix allows traces requirements to design elements to test implementation and any resulting defects.

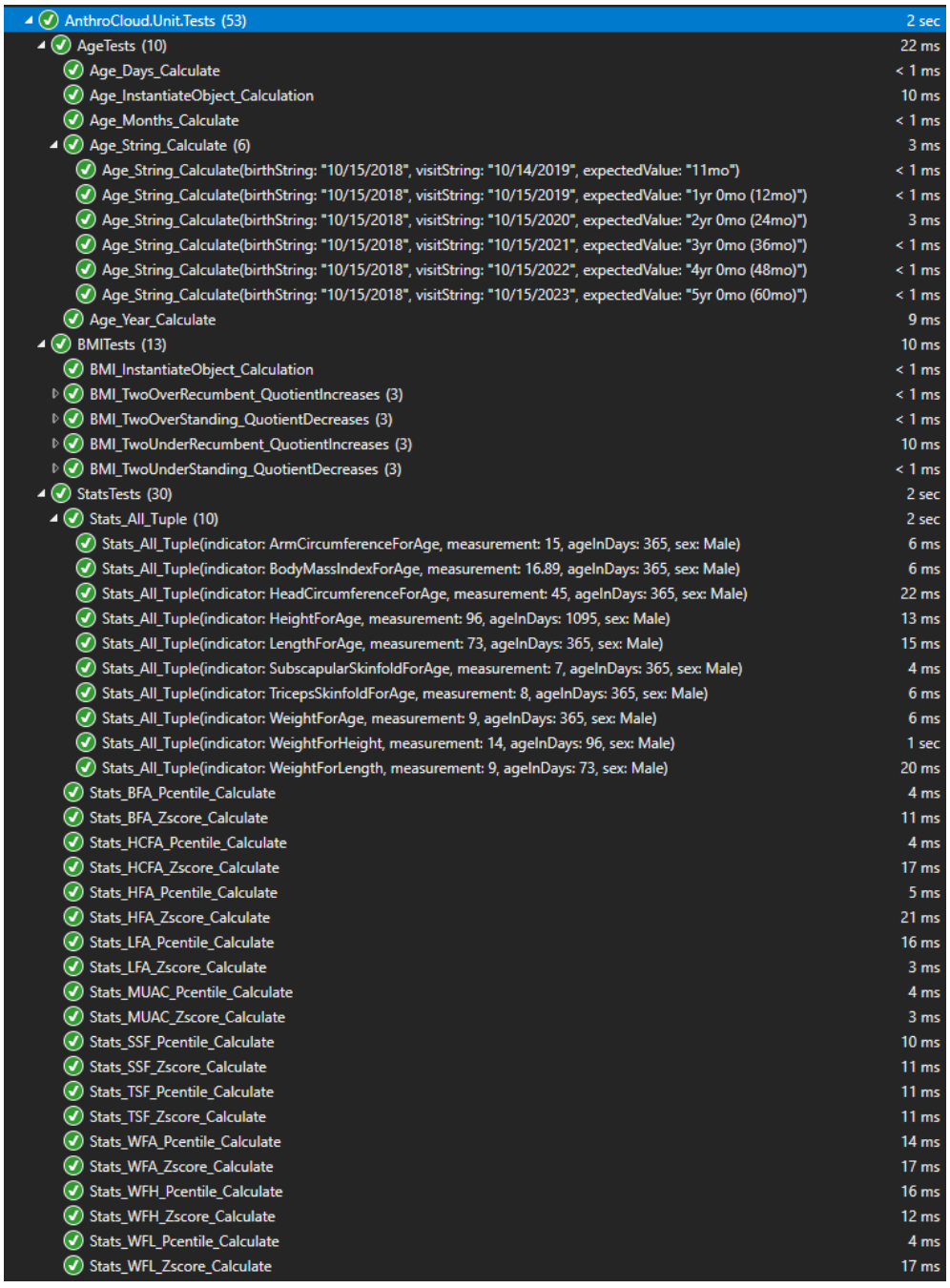
Design (SDS)	Requirements (SRS)	Test Case	Defect
3.5.1, 6.2	UI-1: The solution shall allow data entry for the following inputs: date of visit, sex, date of birth, weight, height, measure type, oedema type, head circumference, MUAC, triceps skinfold, and subscapular skinfold.	ET-1, ET-2, ET-3, ET-4, ET-5, ET-6, ET-7, ET-8, ET-9, ET-10, ET-11, ET-12, ET-41, ET-42, ET-43	DL-1
6.3	UII-1: The solution shall follow the input restrictions specified in Table 1.	ET-1, ET-2, ET-3, ET-4, ET-5, ET-6	DL-10
6.4	UIG-1: The chart shall have a title indicating the anthropometric index.	ET-23 - ET-40, ET-47	n/a
6.4	UIG-2: The chart growth standard used shall be displayed.	ET-23 - ET-40, ET-48	n/a
6.4	UIG-3: The chart shall display a title and unit of measure, if applicable, on the x-axis.	ET-23 - ET-40	n/a
6.4	UIG-4: The chart shall display a title and unit of measure, if applicable, on the y-axis.	ET-23 - ET-40	n/a
6.4	UIG-5: The chart shall adhere to color coded curve lines.	ET-13 - ET-22	n/a
6.4	UIG-6: The chart curve will be labeled with the standard deviation or percentile.	ET-23 - ET-40	n/a
6.4	UIG-7: The plotted score shall be a symbol marker (like an open circle).	ET-23 - ET-40, ET-49	n/a
6.5	UIC-1: The solution shall follow the color coding specified in Software Requirement Specification (SRS) Table 2.	ET-13 - ET-22	n/a
6.2	UIO-1: The application shall display z-score results on the entry screen for all anthropometric indices.	ET-44	DL-2, DL-8, DL-9
6.2	UIO-2: The application shall display percentile results on the entry screen for all anthropometric indices.	ET-45	DL-2, DL-3

6.2	UIO-3: The application shall display Age and BMI values on the entry screen.	UT-1, UT-2, UT-3, UT-4, UT-5, UT-8	n/a
6.4	UIO-4: The application shall display a chart for all anthropometric indices.	ET-46	n/a
3.3	HI-1: The solution shall use the Azure cloud platform.	ST-1	n/a
3.3	HI-2: The solution shall use an Azure App Service.	ST-2	n/a
3.3	HI-3: The solution shall use an Azure database.	ST-3	n/a
3.3	SI-1: The solution shall use a Visual Studio integrated development environment.	ST-4	n/a
3.3	SI-2: The solution shall use an Azure subscription.	ST-5	n/a
3.3	SI-3: The solution shall use a GitHub repository.	ST-6	n/a
3.3	CI-1: The service shall use a RESTful API for HTTP requests.	ST-7	n/a
3.5.5	SF-1: The application service shall calculate Age.	UT1 - UT4, IT-1 – IT-4, ET-50	n/a
3.5.5	SF-2: The application service shall calculate Body Mass Index (BMI).	UT5 - UT8, IT-5	n/a
3.5.6	SF-3: The application service shall calculate Z-scores.	UT-10, UT-12, UT-14, UT-16, UT-18, UT-20, UT-22, UT-24, UT-26, UT-28, UT-29	n/a
3.5.6	SF-4: The application service shall calculate Percentiles.	UT-11, UT-13, UT-15, UT-17, UT-19, UT-21, UT-23, UT-25, UT-27, UT-29	n/a
6.2, 6.4, 3.4.1.1	SF-5: The application shall display a growth chart for eight anthropometric indices.	ET-44, ET-45, ET-46	n/a
5.2, 6.4	SF-6: The application shall chart growth curves for z-scores and percentiles data.	IT-6 – IT-27, IT-28, IT-29	n/a
6.2	SF-7: The application shall chart the individual patient score and percentile.	IT-6 – IT-27, ET-49	n/a
3.4.2.3, 3.5.9	SF-8: The database shall store WHO Child Growth Standard data.	ST-8	n/a
3.6	PER-1: The service shall not exceed 5 seconds for the longest running call.	ST-9	n/a

3.8	DC-1: All HTML code shall conform to HTML 5.0 standard.	ST-10	DL-7
3.3, 3.7	MNT-1: The solution shall use an application, service, and database.	ST-11	n/a
3.4, 3.7, 3.8	MNT-2: The solution shall be architected using layers.	ST-12	n/a
3.7, 3.8	PRT-1: The solution shall use the .NET Core framework.	ST-13	n/a

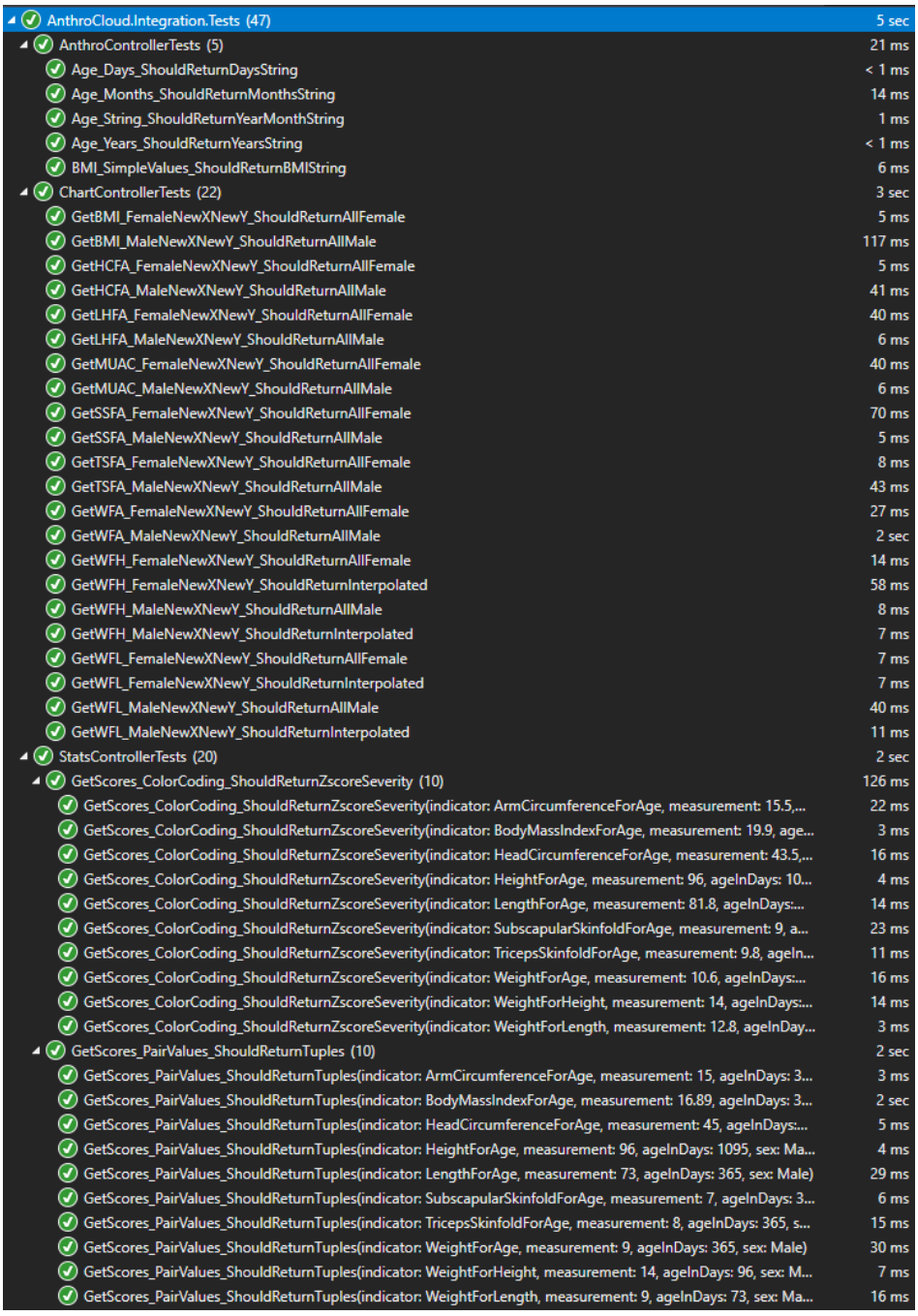
Appendix B – Unit Tests Screenshot

A screenshot from the Visual Studio 2019 Test Explorer shows 53 passing unit tests. Unit tests marked as [Theory] collapse [InLineData] elements loaded to test various scenarios. See multiple scenarios loaded to test the Age_String_Calculate test below.



Appendix C - Integration Tests Screenshot

A screenshot from the Visual Studio 2019 Test Explorer shows 47 passing integration tests. Integration tests marked as [Theory] collapse [InLineData] elements loaded to test various scenarios. See multiple scenarios loaded to test the GetScores_PairValues_ShouldReturnTuples test below.



Appendix D - Test Defect Log

The defects found while testing the AnthroCloud software solution are recorded below.

ID	Test ID	Test Name	Description	Date Rpt	Status
DL-1	IT-25	GetWFL_MaleNewXNewY_ ShouldReturnInterpolated	Received error System.InvalidOperationException: Sequence contains no elements. Test ID-25 fails and cannot debug scenario where WFL values needs interpolation.	11/21/2019	Fixed
DL -2	ET-8	MUAC NA	Percentile and Z-score should equal NA. Range indicator value and test should equal 50.	11/22/2019	Fixed
	ET-9	SSF NA	Percentile and Z-score should equal NA. Range indicator value and test should equal 50.	11/22/2019	Fixed
	ET-10	TSF NA	Percentile and Z-score should equal NA. Range indicator value and test should equal 50.	11/22/2019	Fixed
DL -3	ET-45	Displays 9 Percentiles indicators	Percentile scores >= 99.9 and <= .1 should equal NA.	11/22/2019	Fixed
DL -5	ET-32	Girls SSF Chart	P and Z charts X-axis should not display 0.	11/23/2019	Fixed
	ET-34	Girls TSF Chart	P and Z charts X-axis should not display 0.	11/23/2019	Fixed
DL -6	ET-36	Girls WFA Chart	Z chart X-axis and Y-axis should be defined.	11/23/2019	Fixed
DL -7	ST-10	DC-1: All HTML code shall conform to HTML 5.0 standard.	Received 40 errors and warnings from W3C validator.	11/24/2019	Fixed
DL-8	ET-44	Displays 9 Z-scores indicators	BMI precision increased in backend calculation. BMI rounded on front end.	11/30/2019	Fixed
DL-9	ET-44	Displays 9 Z-scores indicators	Z-Score visible on form in 0.00 format. Tuple item double is 0 not 0.0d rendering -0 html.	11/30/2019	Fixed
DL-10	ET-1 - ET-6	All six range Inputs	Input validation error message shows range.	11/30/2019	Fixed