Assignment #2

Assignment Submission:

Submit your assignment as a SINGLE PDF document online by the due date.

Assignment Deliverables:

Submit your assignment as a single PDF document that has the following:

- Provide your answers for the requirements listed under the **Requirements** section below for the **ImmersiveTech** case study.
- Submit your Assignment_2 online as a SINGLE PDF document with the name **Assignment_2**.

Requirements:

Provide your answers for the following requirements assuming that **ImmersiveTech** has planned to complete the following planned features for **every software release** in **10 months** as follows:

Feature	Requirements	Priority	Release
Customer Management	350	High	R1
Order Management	625	High	R1
Manufacturinng Management	185	High	R2
Supplier Management	80	Medium	R2
Wholesaler Management	145	Medium	R1
Distribution/Shipping Management	180	Low	R2
Data Analyics and BI Reporting	920	High	R3
Timeseries Forecasting Demand/Sales Revenue	540	Medium	R3

Requirement 1: (30 Points) Calculate the total effort needed to complete every phase for every release listed above, given the following size estimates for every phase:

				Size			
Technical Phase	Life Cycle Breakup of Duration	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case
Requirements	15%	Medium (1)	2 FP/Day	5 FP/Req			
Analysis/Design	20%	High (0.7)	3 FP/ 2 Day	8 FP/Req			
Implementation	30%	High (0.7)	50 SLOC/Day		300 SLOC/Req		
Testing	25%	Medium (1)	5 TC/Day				2 TC/ Req
Documentation	10%	Low (1.25)	4 UC/Day			1 UC/ 2 Req	

Ans.

Release R1

Feature: Customer Management (Requirements = 350)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				350 * 5 = 1750 FP	1750 / 2 * 1 = **875 Days**

Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				350 * 8 = 2800 FP	2800 / 1.5 * 0.7 = **2667 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			350 * 300 = 105,000 FP	105000 / 50 * 0.7 = **3000 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	350 * 2 = 700 FP	700 / 5 * 1 = **140 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		350 * 0.5 = 175 FP	175 / 4 * 1.25 = **35 Days**

Customer Management Total Effort = **6717 Days**

Feature: Order Management (Requirements = 625)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				625 * 5 = 3125 FP	3125 / 2 * 1 = **1563 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				625 * 8 = 5000 FP	5000 / 1.5 * 0.7 = **4762 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			625 * 300 = 187,500 FP	187500 / 50 * 0.7 = **5358 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	625 * 2 = 1250 FP	1250 / 5 * 1 = **250 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		625 * 0.5 = 313 FP	313 / 4 * 1.25 = **63 Days**

Order Management Total Effort = **11996 Days**

Feature: Wholesaler Management (Requirements = 145)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				145 * 5 = 725 FP	725 / 2 * 1 = **363 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				145 * 8 = 1160 FP	1160 / 1.5 * 0.7 = **1105 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			145 * 300 = 43500 FP	43500 / 50 * 0.7 = **1243 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	145 * 2 = 290 FP	290 / 5 * 1 = **58 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		145 * 0.5 = 73 FP	73 / 4 * 1.25 = **15 Days**

Wholesaler Management Total Effort = **2784 Days**

Release R2

Feature: Manufacturing Management (Requirements = 185)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				185 * 5 = 925 FP	925 / 2 * 1 = **463 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				185 * 8 =	1480 / 1.5

							1480 FP	* 0.7 = **1410 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			185 * 300 = 55500 FP	55500 / 50 * 0.7 = **1586 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	185 * 2 = 370 FP	370 / 5 * 1 = **74 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		185 * 0.5 = 93 FP	93 / 4 * 1.25 = **19 Days**

Manufacturing Management Total Effort = **3552 Days**

Feature: Supplier Management (Requirements = 80)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				80 * 5 = 400 FP	400 / 2 * 1 = **200 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				80 * 8 = 640 FP	640 / 1.5 * 0.7 = **610 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			80 * 300 = 24000 FP	24000 / 50 * 0.7 = **686 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	80 * 2 = 160 FP	160 / 5 * 1 = **32 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		80 * 0.5 = 40 FP	40 / 4 * 1.25 = **8**

								Days

Supplier Management Total Effort = **1536 Days**

Feature: Distribution/ Shipping Management (Requirements = 180)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				180 * 5 = 900 FP	900 / 2 * 1 = **450 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				180 * 8 = 1440 FP	1440 / 1.5 * 0.7 = **1372 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			180 * 300 = 54000 FP	54000 / 50 * 0.7 = **1543 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	180 * 2 = 360 FP	360 / 5 * 1 = **72 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		180 * 0.5 = 90 FP	90 / 4 * 1.25 = **18 Days**

Distribution/ Shipping Management Total Effort = **3455 Days**

Release R3

Feature: Analytics and BI Reporting (Requirements = 920)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				920 * 5 =	4600 / 2 * 1 =

							4600 FP	**2300 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				920 * 8 = 7360 FP	7360 / 1.5 * 0.7 = **7010 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			920 * 300 = 276000 FP	276000 / 50 * 0.7 = **7886 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	920 * 2 = 1840 FP	1840 / 5 * 1 = **368 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/ 2 Req		920 * 0.5 = 460 FP	460 / 4 * 1.25 = **92 Days**

Analytics and BI Reporting Total Effort = **17656 Days**

Feature: Timeseries Forecasting Demand/ Sales Revenue (Requirements = 540)								
Technical Phase	Complexity	Productivity Rate	Function Points	Lines of Code	Use-Case	Test-Case	Total Size (FPS = R * S)	Total Effort (FPS/ PR * C)
Requirements	Medium(1)	2 FP/Day	5 FP/Req				540 * 5 = 2700 FP	2700 / 2 * 1 = **1350 Days**
Analysis/Design	High(0.7)	3 FP/2 Day	8 FP/Req				540 * 8 = 4320 FP	4320 / 1.5 * 0.7 = **4115 Days**
Implementation	High(0.7)	50 SLOC/Day		300 SLOC/Req			540 * 300 = 162000 FP	162000 / 50 * 0.7 = **4629 Days**
Testing	Medium(1)	5 TC/Day				2 TC/Req	540 * 2 = 1080 FP	1080 / 5 * 1 = **216 Days**
Documentation	Low (1.25)	4 UC/Day			1 UC/		540 * 0.5 =	270 / 4 * 1.25

					2 Req		270 FP	= **54 Days**

Timeseries Forecasting Demand/ Sales Revenue = **10364 Days**

R1	Customer Management	Order Management	Wholesaler Management	Effort
Requirements	875 Days	1563 Days	363 Days	**2801 Days**
Analysis/ Design	2667 Days	4762 Days	1105 Days	**8534 Days**
Implementation	3000 Days	5358 Days	1243 Days	**9601 Days**
Testing	140 Days	250 Days	58 Days	**448 Days**
Documentation	35 Days	63 Days	15 Days	**113 Days**

Total Effort for R1 release = **21497 Days**

2	Manufacturing Management	Supplier Management	Distribution/ Shipping Management	Effort
Requirements	463 Days	200 Days	450 Days	**1113 Days**
Analysis/ Design	1410 Days	610 Days	1372 Days	**3392 Days**
Implementation	1586 Days	686 Days	1543 Days	**3815 Days**
Testing	74 Days	32 Days	72 Days	**178 Days**
Documentation	19 Days	8 Days	18 Days	**45 Days**

Total Effort for R2 Release = **8543 Days**

R3	Data Analytics and BI Reporting	Timeseries Forecasting Demand/ Sales Revenue	Effort
Requirements	2300 Days	1350 Days	**3650 Days**
Analysis/ Design	7010 Days	4115 Days	**11125 Days**
Implementation	7886 Days	4629 Days	**12515 Days**
Testing	368 Days	216 Days	**584 Days**
Documentation	92 Days	54 Days	**146 Days**

Total Effort for R3 Release = **28020 Days**

Requirement 2: (30 Points) Calculate the total number of engineers for every phase in every release based on the results you obtained in Requirement 1.

Ans.

R1	Lifecycle Breakup of Duration	Customer Management	Order Management	Wholesaler Management	Effort	No. of Engineers(Effort / Duration * Lifecycle Breakup of Duration)
Requirements	15%	875 Days	1563 Days	363 Days	2801 Days	2801 / 300 * 0.15 = **63**
Analysis/ Design	20%	2667 Days	4762 Days	1105 Days	8534 Days	8534 / 300 * 0.2 = **143**
Implementation	30%	3000 Days	5358 Days	1243 Days	9601 Days	9601 / 300 * 0.3 = **107**
Testing	25%	140 Days	250 Days	58 Days	448 Days	448 / 300 * 0.25 = **6**
Documentation	10%	35 Days	63 Days	15 Days	113 Days	113 / 300 * 0.1 = **4**

Total No. of Engineers for R1 Release = **323**

R2	Lifecycle Breakup of Duration	Manufacturing Management	Supplier Management	Distribution/ Shipping Management	Effort	No. of Engineers(Effort / Duration * Lifecycle Breakup of Duration)
Requirements	15%	463 Days	200 Days	450 Days	1113 Days	1113 / 300 * 0.15 = **25**
Analysis/ Design	20%	1410 Days	610 Days	1372 Days	3392 Days	3392 / 300 * 0.2 = **57**
Implementation	30%	1586 Days	686 Days	1543 Days	3815 Days	3815 / 300 * 0.3 = **43**
Testing	25%	74 Days	32 Days	72 Days	178 Days	178 / 300 * 0.25 = **3**
Documentation	10%	19 Days	8 Days	18 Days	45 Days	45 / 300 * 0.1 = **2**

Total No. of Engineers for R2 Release = **130**

R3	Lifecycle Breakup of Duration	Data Analytics and BI Reporting	Timeseries Forecasting Demand/ Sales Revenue	Effort	No. of Engineers(Effort / Duration * Lifecycle Breakup of Duration)

Requirements	15%	2300 Days	1350 Days	3650 Days	3650 / 300 * 0.15 = **82**
Analysis/ Design	20%	7010 Days	4115 Days	11125 Days	11125 / 300 * 0.2 = **186**
Implementation	30%	7886 Days	4629 Days	12515 Days	12515 / 300 * 0.3 = **140**
Testing	25%	368 Days	216 Days	584 Days	584 / 300 * 0.25 = **8**
Documentation	10%	92 Days	54 Days	146 Days	146 / 300 * 0.1 = **5**

Total No. of Engineers for R3 Release = **421**

Requirement 3: (20 Points) Redo your calculations for Requiremnet 1 and Requirement 2 assuming that ImmersiveTech planned to finish every release in 8 months.

Ans.

R1	Lifecycle Breakup of Duration	Customer Management	Order Management	Wholesaler Management	Effort	No. of Engineers(Effort / Duration * Lifecycle Breakup of Duration)
Requirements	15%	875 Days	1563 Days	363 Days	2801 Days	2801 / 240 * 0.15 = **78**
Analysis/ Design	20%	2667 Days	4762 Days	1105 Days	8534 Days	8534 / 240 * 0.2 = **178**
Implementation	30%	3000 Days	5358 Days	1243 Days	9601 Days	9601 / 240 * 0.3 = **134**
Testing	25%	140 Days	250 Days	58 Days	448 Days	448 / 240 * 0.25 = **8**
Documentation	10%	35 Days	63 Days	15 Days	113 Days	113 / 240 * 0.1 = **5**

Total No. of Engineers for R1 Release = **403**

R2	Lifecycle Breakup of Duration	Manufacturing Management	Supplier Management	Distribution/ Shipping Management	Effort	No. of Engineers(Effort / Duration * Lifecycle Breakup of Duration)

Requirements	15%	463 Days	200 Days	450 Days	1113 Days	1113 / 240 * 0.15 = **31**
Analysis/ Design	20%	1410 Days	610 Days	1372 Days	3392 Days	3392 / 240 * 0.2 = **71**
Implementation	30%	1586 Days	686 Days	1543 Days	3815 Days	3815 / 240 * 0.3 = **53**
Testing	25%	74 Days	32 Days	72 Days	178 Days	178 / 240 * 0.25 = **3**
Documentation	10%	19 Days	8 Days	18 Days	45 Days	45 / 240 * 0.1 = **2**

Total No. of Engineers for R1 Release = **160**

R3	Lifecycle Breakup of Duration	Data Analytics and BI Reporting	Timeseries Forecasting Demand/ Sales Revenue	Effort	No. of Engineers(Effort / Duration * Lifecycle Breakup of Duration)
Requirements	15%	2300 Days	1350 Days	3650 Days	3650 / 240 * 0.15 = **102**
Analysis/ Design	20%	7010 Days	4115 Days	11125 Days	11125 / 240 * 0.2 = **232**
Implementation	30%	7886 Days	4629 Days	12515 Days	12515 / 240 * 0.3 = **174**
Testing	25%	368 Days	216 Days	584 Days	584 / 240 * 0.25 = **10**
Documentation	10%	92 Days	54 Days	146 Days	146 / 240 * 0.1 = **7**

Total No. of Engineers for R1 Release = **525**

Requirement 4: (20 Points) Calculate the total effort (Headcount Days) for every phase in every release based on the results you obtained in Requirement 1, considering the following quality cost data:

		Effort (Headcount Day)	
Technical Phase	**Defects Found**	**Defect Detection**	**Defect Removal**
Requirements	2 DF/ 5 FP	2 DF/Day	1 DF/Day
Analysis/Design	3 DF/ 5 FP	3 DF/Day	3 DF/Day
Implementation	5 DF/ 100 SLOC	5 DF/Day	10 DF/Day
Testing	2 DF/ 9 TC	5 DF/Day	1 DF/Day
Documentation	1 DF/ 5 UC	6 DF/Day	13 DF/Day

Ans.

For Release R1

Feature: Customer Management					
Technical Phase	Total Size	Total Defects (Size * Defects Found)	Defect Detection Cost (Size / Defect Detection)	Defect Removal Cost (Size / Defect Removal)	Cost of Quality (Defect Detection + Defect Removal)
Requirements	1750	1750 * 2/5 = 700	700/2 = 350	700/1 = 700	**1050**
Analysis/ Design	2800	2800 * 3/5 = 1680	1680/3 = 560	1680/3 = 560	**1120**
Implementation	105000	105000 * 5/100 = 5250	5250/5 = 1050	5250/10 = 525	**1575**
Testing	700	700 * 2/9 = 156	156/5 = 32	156/1 = 156	**188**
Documentation	175	175 * 1/5 = 35	35/6 = 6	35/13 = 3	**9**

Feature: Order Management

Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality
Requirements	3125	3125 * 2/5 = 1250	1250/2 = 625	1250/1 = 1250	**1875**
Analysis/ Design	5000	5000 * 3/5 = 3000	3000/3 = 1000	3000/3 = 1000	**2000**
Implementation	187500	187500 * 5/100 = 9375	9375/5 = 1875	9375/10 = 938	**2813**
Testing	1250	1250 * 2/9 = 278	278/5 = 56	278/1 = 278	**334**
Documentation	313	313 * 1/5 = 63	63/6 = 11	63/13 = 5	**16**

Feature: Wholesaler Management					
Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality
Requirements	725	725 * 2/5 = 290	290/2 = 145	290/1 = 290	**435**
Analysis/ Design	1160	1160 * 3/5 = 696	696/3 = 232	696/3 = 232	**464**
Implementation	43500	43500 * 5/100 = 2175	2175/5 = 435	2175/10 = 218	**653**
Testing	290	290 * 2/9 = 65	65/5 = 13	65/1 = 65	**78**
Documentation	73	73 * 1/5 = 15	15/6 = 3	15/13 = 2	**5**

For Release R2

Feature: Manufacturing Management					
Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality

Requirements	925	925 * 2/5 = 370	370/2 = 185	370/1 = 370	**555**
Analysis/ Design	1480	1480 * 3/5 = 888	888/3 = 296	888/3 = 296	**592**
Implementation	55500	55500 * 5/100 = 2775	2775/5 = 555	2775/10 = 278	**833**
Testing	370	370 * 2/9 = 83	83/5 = 17	83/1 = 83	**100**
Documentation	93	93 * 1/5 = 19	19/6 = 4	19/13 = 2	**6**

Feature: Supplier Management					
Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality
Requirements	400	400 * 2/5 = 160	160/2 = 80	160/1 = 160	**240**
Analysis/ Design	640	640 * 3/5 = 384	384/3 = 128	384/3 = 128	**256**
Implementation	24000	24000 * 5/100 = 1200	1200/5 = 240	1200/10 = 120	**360**
Testing	160	160 * 2/9 = 36	36/5 = 8	36/1 = 36	**44**
Documentation	40	40 * 1/5 = 8	8/6 = 2	8/13 = 1	**3**

Feature: Distribution/ Shipping Management					
Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality
Requirements	900	900 * 2/5 = 360	360/2 = 180	360/1 = 360	**540**
Analysis/ Design	1440	1440 * 3/5 = 864	864/3 = 288	864/3 = 288	**576**

Implementation	54000	54000 * 5/100 = 2700	2700/5 = 540	2700/10 = 270	**810**
Testing	360	360 * 2/9 = 80	80/5 = 16	80/1 = 80	**96**
Documentation	90	90 * 1/5 = 18	18/6 = 3	18/13 = 2	**5**

For Release R3

Feature: Data Analytics BI Reporting					
Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality
Requirements	4600	4600 * 2/5 = 1840	1840/2 = 920	1840/1 = 1840	**2760**
Analysis/ Design	7360	7360 * 3/5 = 4416	4416/3 = 1472	4416/3 = 1472	**2944**
Implementation	276000	276000 * 5/100 = 13800	13800/5 = 2760	13800/10 = 1380	**4140**
Testing	1840	1840 * 2/9 = 409	409/5 = 82	409/1 = 409	**491**
Documentation	460	460 * 1/5 = 92	92/6 = 16	92/13 = 8	**24**

Feature: Timeseries Forecasting Demand/ Sales Revenue					
Technical Phase	Total Size	Total Defects	Defect Detection Cost	Defect Removal Cost	Cost of Quality
Requirements	2700	2700 * 2/5 = 1080	1080/2 = 540	1080/1 = 1080	**1620**
Analysis/ Design	4320	4320 * 3/5 = 2592	2592/3 = 864	2592/3 = 864	**1728**

Implementation	162000	162000 * 5/100 = 8100	8100/5 = 1620	8100/10 = 810	**2430**
Testing	1080	1080 * 2/9 = 240	240/5 = 48	240/1 = 240	**288**
Documentation	270	270 * 1/5 = 54	54/6 = 9	54/13 = 5	**14**

R1	Customer Management	Order Management	Wholesaler Management	Cost of Quality
Requirements	1050	1875	435	**3360**
Analysis/ Design	1120	2000	464	**3584**
Implementation	1575	2813	653	**5041**
Testing	188	334	78	**600**
Documentation	9	16	5	**30**

Total Cost of Quality for R1 Release : **12615 Days**

R2	Manufacturing Management	Supplier Management	Distribution/ Shipping Management	Cost of Quality
Requirements	555	240	540	**1335**
Analysis/ Design	592	256	576	**1424**
Implementation	833	360	810	**2003**
Testing	100	44	96	**240**
Documentation	6	3	5	**14**

Total Cost of Quality for R2 Release : **5016 Days**

R3	Data Analytics and BI Reporting	Timeseries Forecasting Demand/ Sales Revenue	Cost of Quality
Requirements	2760	1620	**4380**
Analysis/ Design	2944	1728	**4672**
Implementation	4140	2430	**6570**
Testing	491	288	**779**
Documentation	24	14	**38**

Total Cost of Quality for R3 Release : **16439 Days**