# Report for Assignment 2 SIT374 Question #1

Question #2

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#### Question #1

# A: The NPV and ROI for each investment option, payback analysis charts and analysis of these charts.

#### Project1

#### 1. Description

To insulate the current company offices at a cost of \$18,000 which will provide a fuel savings of \$1,600 per year over the next 10 years.

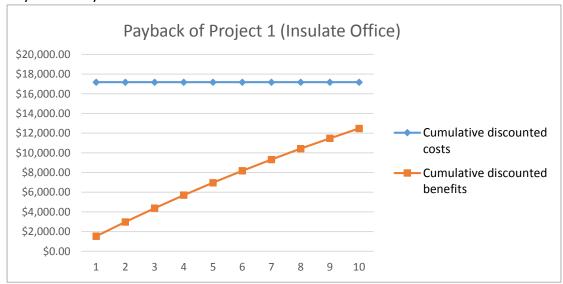
#### 2. NPV and ROI

The NPV of project 1 is -\$4,699.92 and the ROI is -27%, there is a table (Graph 1.1.0) which illustrate the trend of cost and benefit.

PROJECT 1						Year					Total
(Insulate Office)	1	2	3	4	5	6	7	8	9	10	iotai
Costs	\$18,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18,000.00
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted costs	\$17,175.57	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$17,175.57
Cumulative discounted costs	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$17,175.57	\$171,755.73
Benefits	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$16,000.00
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted benefits	\$1,526.72	\$1,456.79	\$1,390.07	\$1,326.40	\$1,265.65	\$1,207.68	\$1,152.37	\$1,099.59	\$1,049.22	\$1,001.17	\$12,475.66
Cumulative discounted benefits	\$1,526.72	\$2,983.51	\$4,373.58	\$5,699.98	\$6,965.63	\$8,173.31	\$9,325.68	\$10,425.26	\$11,474.49	\$12,475.66	\$73,423.81
Cash flow	-\$16,400.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	\$1,600.00	-\$2,000.00
Discounted benefits - costs	-\$15,648.85	\$1,456.79	\$1,390.07	\$1,326.40	\$1,265.65	\$1,207.68	\$1,152.37	\$1,099.59	\$1,049.22	\$1,001.17	-\$4,699.92
Cumulative benefits - costs	-\$15,648.85	-\$14,192.06	-\$12,802.00	-\$11,475.59	-\$10,209.94	-\$9,002.26	-\$7,849.90	-\$6,750.31	-\$5,701.08	-\$4,699.92	-\$98,331.92
NPV	-\$4,699.92										
ROI	-27%										

Graph 1.1.0

#### 3. Payback analysis chart



Graph 1.1.1

#### 4. Analysis

What we can see in this chart is the line of cumulative discounted benefits are increasing during these 10 years and benefit can be received in the first year, however, there is a fact is that the value of cumulative discounted benefits are less than the cumulative discounted costs. At the end of the 10<sup>th</sup> year, the value of cumulative discounted benefits are still less than cumulative discounted costs, indicating that the project does not have profit finally.

#### **Project 2**

#### 1. Description

To pay the lump sum of \$30,000 to the mortgage of \$40,000 that has a loan term of 10 years at 6.5% interest per annum.

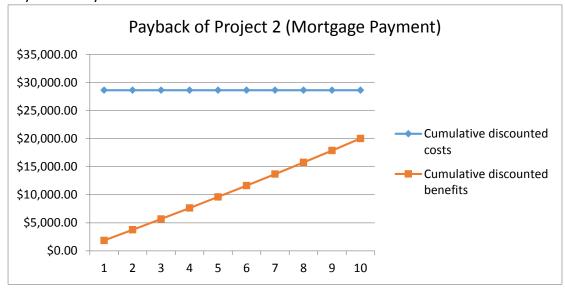
#### 2. NPV and ROI

The NPV of project 1 is -\$8,600.40 and the ROI is -30%, there is a table (Graph 1.2.0) which illustrate the trend of cost and benefit.

PROJECT 2						Year					w
(Mortgage Payment)	1	2	3	4	5	6	7	8	9	10	Total
Costs	\$30,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30,000.00
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted costs	\$28,625.95	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28,625.95
Cumulative discounted costs	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$28,625.95	\$286,259.54
							•				
Benefits	\$ 1,950.00	\$ 2,076.75	\$ 2,211.74	\$ 2,355.50	\$ 2,508.61	\$ 2,671.67	\$ 2,845.33	\$ 3,030.27	\$ 3,227.24	\$ 3,437.01	\$26,314.12
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted benefits	\$1,860.69	\$1,890.87	\$1,921.54	\$1,952.71	\$1,984.39	\$2,016.58	\$2,049.29	\$2,082.53	\$2,116.31	\$2,150.64	\$20,025.55
Cumulative discounted benefits	\$1,860.69	\$3,751.56	\$5,673.10	\$7,625.81	\$9,610.20	\$11,626.78	\$13,676.07	\$15,758.60	\$17,874.91	\$20,025.55	\$107,483.26
Cash flow	-\$28,050.00	\$2,076.75	\$2,211.74	\$2,355.50	\$2,508.61	\$2,671.67	\$2,845.33	\$3,030.27	\$3,227.24	\$3,437.01	-\$3,685.88
Discounted benefits - costs	-\$26,765.27	\$1,890.87	\$1,921.54	\$1,952.71	\$1,984.39	\$2,016.58	\$2,049.29	\$2,082.53	\$2,116.31	\$2,150.64	-\$8,600.40
Cumulative benefits - costs	-\$26,765.27	-\$24,874.40	-\$22,952.85	-\$21,000.14	-\$19,015.75	-\$16,999.18	-\$14,949.89	-\$12,867.36	-\$10,751.04	-\$8,600.40	-\$178,776.28
											· ·
NPV	-\$8,600.40			, in the second			, in the second				, and the second
ROI	-30%										

**Graph1.2.0** 

#### 3. Payback analysis chart



Graph 1.2.1

#### 4. Analysis

According to this char, cumulative discounted benefits are going up during these 10 years and benefit can be received in the first year, however, there is a fact is that the value of cumulative discounted benefits are less than the cumulative discounted costs. At the end of the 10th year, the value of cumulative discounted benefits are still less than cumulative discounted costs, which means the project does not have profit finally.

#### **Project 3**

#### 1. Description

To invest \$20,000 into a new business, which has been estimated to return the double amount in 6 years' time.

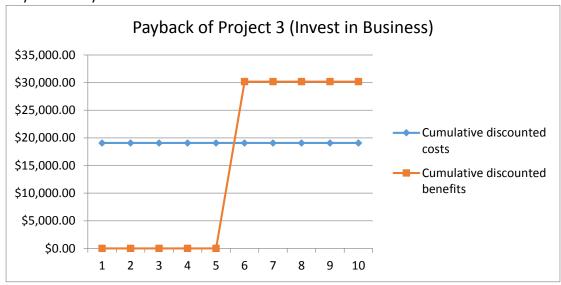
#### 2. NPV and ROI

The NPV of project 1 is \$11,108.06 and the ROI is 58%, there is a table (Graph 1.3.0) which illustrate the trend of cost and benefit.

PROJECT 3						Year					
(Invest in Business)	1	2	3	4	5	6	7	8	9	10	Total
Costs	\$20,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20,000.00
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted costs	\$19,083.97	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$19,083.97
Cumulative discounted costs	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$19,083.97	\$190,839.69
Benefits	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40,000.00
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted benefits	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30,192.03	\$0.00	\$0.00	\$0.00	\$0.00	\$30,192.03
Cumulative discounted benefits	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30,192.03	\$30,192.03	\$30,192.03	\$30,192.03	\$30,192.03	\$150,960.14
Cash flow	-\$20,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20,000.00
Discounted benefits - costs	-\$19,083.97	\$0.00	\$0.00	\$0.00	\$0.00	\$30,192.03	\$0.00	\$0.00	\$0.00	\$0.00	\$11,108.06
Cumulative benefits - costs	-\$19,083.97	-\$19,083.97	-\$19,083.97	-\$19,083.97	-\$19,083.97	\$11,108.06	\$11,108.06	\$11,108.06	\$11,108.06	\$11,108.06	-\$39,879.55
NPV	\$11,108.06										
ROI	58%										

Graph 1.3.0

#### 3. Payback analysis chart



Graph 1.3.1

#### 4. Analysis

Overall, the value of cumulative discounted costs are sustained over the 10 years, the line of cumulative discounted benefits are zero between the previous 5 years and then goes up suddenly to a peak value of \$30,000, which lasted until the last year.

Specifically, the time to generate benefits is the fifth year, which is a little late. However, the value of benefits rise fast in a year. In the last year, it is obvious that the value of cumulative discounted benefits are more than the value of cumulative discounted costs, which means the benefits outweigh the investment finally.

#### **Project 4**

#### 1. Description

To keep the profit \$50,000 in an iSaver account earning a fixed interest of 4.5% per annum for 8 years. After 8 years, there will be no interest for this iSaver account.

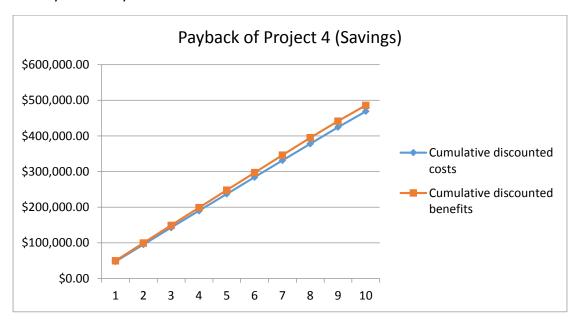
#### 2. NPV and ROI

The NPV of this project is \$17,004.47 and the ROI is 4%, there is a chart (Graph 1.4.0) to show the trend of cost and benefit.

PROJECT 4						Year					
(iSaver - no investment)	1	2	3	4	5	6	7	8	9	10	Total
Costs	\$50,000.00	\$52,250.00	\$54,601.25	\$57,058.31	\$59,625.93	\$62,309.10	\$65,113.01	\$68,043.09	\$71,105.03	\$71,105.03	\$611,210.74
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted costs	\$47,709.92	\$47,573.35	\$47,437.17	\$47,301.37	\$47,165.97	\$47,030.95	\$46,896.32	\$46,762.08	\$46,628.21	\$44,492.57	\$468,997.91
Cumulative discounted costs	\$47,709.92	\$95,283.27	\$142,720.44	\$190,021.81	\$237,187.78	\$284,218.73	\$331,115.05	\$377,877.13	\$424,505.34	\$468,997.91	\$2,599,637.39
Benefits	\$52,250.00	\$54,601.25	\$57,058.31	\$59,625.93	\$62,309.10	\$65,113.01	\$68,043.09	\$71,105.03	\$71,105.03	\$71,105.03	\$632,315.77
Discount factor	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63	\$7.80
Discounted benefits	\$49,856.87	\$49,714.15	\$49,571.84	\$49,429.93	\$49,288.44	\$49,147.34	\$49,006.65	\$48,866.37	\$46,628.21	\$44,492.57	\$486,002.38
Cumulative discounted benefits	\$49,856.87	\$99,571.02	\$149,142.86	\$198,572.79	\$247,861.23	\$297,008.57	\$346,015.23	\$394,881.60	\$441,509.81	\$486,002.38	\$2,710,422.37
Cash flow	\$2,250.00	\$2,351.25	\$2,457.06	\$2,567.62	\$2,683.17	\$2,803.91	\$2,930.09	\$3,061.94	\$0.00	\$0.00	\$21,105.03
Discounted benefits - costs	\$2,146.95	\$2,140.80	\$2,134.67	\$2,128.56	\$2,122.47	\$2,116.39	\$2,110.33	\$2,104.29	\$0.00	\$0.00	\$17,004.47
Cumulative benefits - costs	\$2,146.95	\$4,287.75	\$6,422.42	\$8,550.98	\$10,673.45	\$12,789.84	\$14,900.18	\$17,004.47	\$17,004.47	\$17,004.47	\$110,784.98
			•					•			
NPV	\$17,004.47										
ROI	4%										

Graph 1.4.0

#### 3. Payback analysis chart



**Graph 1.4.1** 

#### 4. Analysis

In total, the trend of cumulative discounted costs and benefits are increasing over the ten years and the benefit is more than costs finally. In details, what should be paid more attention is that the benefits can be received in the first year, but the difference between benefits and costs does not increase too much.

#### B: Details of weighted score model solution including charts

#### What weights have used and why?

Weighted score model has been used for making investment decision. In this model, NPV, ROI and payback analysis have been considered and the reasons has been given below.

NPV is the abbreviation for Net Present Value, which means an analysis of cash flow and the calculation of anticipated cash flow on a yearly basis. Risks and depreciation of money have been considered in the calculation of NPV so that it can be used to determine whether the project can achieve the expected rate of return. In addition, NPV should be greater than 0 and the larger value is better.

ROI is the abbreviation for Return on Investment, which means the ratio of average annual profit to project investment. The usage of ROI calculation is benefit for judging the performance of investment. ROI should be greater than 0 and the larger value is better.

Payback analysis includes the description of payback period, the change of cumulative costs and benefits and other related aspects. Therefore, it is useful to make the evaluation for an investment.

#### How to derive/calculate score for each investment option and criterion?

The percentage of NPV is 50%, ROI is 20% and payback analysis is 30%. The score of NPV is based on the comparison among several projects and the score of payback analysis is based on the analysis of charts. As for the score of SOI, there is a table (Table 2.1) to make evaluation.

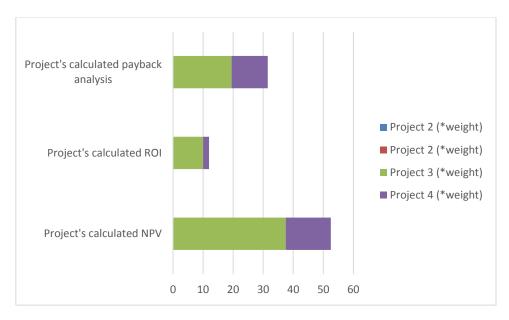
Percentage	Score (out of 100)
<=0%	0
0% - 20%	10
20% - 40%	30
40% - 60%	50
60% - 80%	70
80% - 100%	90
=100%	100

**Table 2.2.0** 

#### Scores for each option/criterion, and total sum

			Project 2		Project 2		Project 3		Project 4
Criteria	Weight	Project 1	(*weight)	Project 2	(*weight)	Project 3	(*weight)	Project 4	(*weight)
Project's calculated NPV	50%	0	0	0	0	75	37.5	30	15
Project's calculated ROI	20%	0	0	0	0	50	10	10	2
Project's calculated payback analysis	30%	0	0	0	0	65	19.5	40	12
Totals	100%		0		0		67		29

**Table 2.3.0** 



Graph 2.3.1

#### **Final decision**

In conclusion, according to the statistics in above table 2.3.0 and graph 2.3.1, project 3 should be chosen. Firstly, the weighted score of project 3 is the highest among the four projects. Secondly, the ROI of project 3 is 58%, which is the largest one. The NPV of this project is more than 0, which means it can achieve expected rate of return. What's more, it is obvious that project 3 is the one which can earn benefits at most in the shortest possible time among four projects. Therefore, project 3 should be invested.

#### Question #2

#### A: PV of the entire project (the whole table can be found in Appendix)

ID	Task Name	Planned Value (PV)
1	Lay foundations	18,000
2	Build frame	34,000
3	Install pipes and electrical	10,000
4	Make house water-tight	15,000
5	Install internal walls and bathroom	20,000
6	Install cabinetries	14,000
7	Paint house	8,000
8	Install light fixtures and appliances	9,000
	Project planned value (PV)	128,000

**Table 2.1.0** 

#### B: PV, AC, EV, SV, CPI and SPI

#### PV of the project up to date (up to task 4)

ID	Task Name	PV (to date)
1	Lay foundations	\$18,000.00
2	Build frame	\$34,000.00
3	Install pipes and electrical	\$10,000.00
4	Make house water-tight	\$15,000.00
	Project planned value (PV)	\$77,000.00

**Table 2.2.0** 

#### AC of the project and explain how to get these values (up to task 4)

1. The AC of the project are shown in the table 2.2.1

	Project planned value (PV)	\$77,000
4	Make house water-tight	\$15,000
3	Install pipes and electrical	\$10,000
2	Build frame	\$34,000
1	Lay foundations	\$18,000
ID	Task Name	Actual costs (AC)

**Table 2.2.1** 

2. The methods to get these values

The project manager has managed to keep cost to what was originally budgeted up to task 4. Therefore, the actual value of the four tasks equal the cost at first.

#### For each task, calculate the Rate of Performance, EV, SV, CPI, SPI

ID	Task Name	Rate of Performance (RP)	Earned Value (EV)	Schedule Variance (SV)	Cost Performance Index (CPI)	Schedule Performance Index (SPI)
1	Lay foundations	100%	\$18,000	\$0		
2	Build frame	100%	\$34,000	\$0	100%	1000/
3	Install pipes and electrical	100%	\$10,000	\$0	100%	100%
4	Make house water-tight	100%	\$15,000	\$0		
		100%	\$77,065	<b>\$0</b>		

**Table 2.2.2** 

C: Delays

**CPI** and **SPI** for the delayed tasks

ID	Task Name	Cost Performance Index (CPI)	Schedule Performance Index (SPI)
1	Lay foundations		
2	Build frame		
3	Install pipes and electrical		
4	Make house water-tight		
5	Install internal walls and bathroom	100%	100%
6	Install cabinetries	68%	85%
7	Paint house	64%	84%
8	Install light fixtures and appliances	59%	83%
		90%	96%

**Table 2.3.0** 

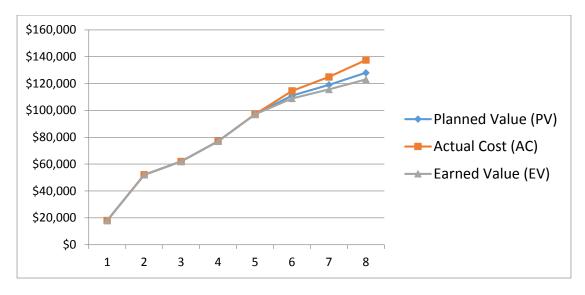
## Performance with respect to cost and time? Is the project on budget and schedule? How did you know? What metrics tell you this information?

According to the whole table in Appendix, the total actual costs is more than total plan value and the cost performance index of task 6, 7, and 8 are less than 100%, illustrating the project is over budget.

Moreover, the schedule variance of task 6, 7, and 8 are below 0 and the schedule performance index are below 100%, which indicates the project is behind schedule.

## Chart of the EV, PV, and AC – comment on the interval between tasks 1 to 5, and tasks 6 to 8

#### 1. Chart of the EV, PV, and AC



**Table 2.5.0** 

#### 2. Comment

As for the task 1 to 5, the earned value equals planned value and actual cost, indicating the project is completed as plan in terms of schedule and cost. However, it is obvious that the actual cost and planned value is above of earned value from task6 to 8, which shows that the project is over budget and behind of schedule.

## Appendix: the whole table of Question #2

ID	Task Name	Cost (\$)	Duration (Expected)	Dura (Act	ation :ual)	Planned Value (PV)	PV (to date)	Actual costs (AC)	Rate of Performance (RP)	Earned Value (EV)	Schedule Variance (SV)		Schedule Perform ance Index (SPI)
1	Lay foundations	18,000	2 weeks	2	weeks	\$18,000.00	\$18,000.00	\$18,000	100%	\$18,000	\$0		
2	Build frame	34,000	4 weeks	4	weeks	\$34,000.00	\$34,000.00	\$34,000	100%	\$34,000	\$0		
3	Install pipes and electrical	10,000	6 weeks	6	weeks	\$10,000.00	\$10,000.00	\$10,000	100%	\$10,000	\$0		
4	Make house water-tight	15,000	8 weeks	8	weeks	\$15,000.00	\$15,000.00	\$15,000	100%	\$15,000	\$0		
5	Install internal walls and bathroom	20,000	12 weeks	12	weeks	\$20,000.00	\$20,000.00	\$20,000	100%	\$20,000	\$0	100%	100%
6	Install cabinetries -	14,000	4 weeks	4	weeks	\$14,000.00	\$14,000.00		80%	\$11,200			
U		Sched	lule overrun	1	weeks		\$3,500.00	\$17,500	20%	\$700	-\$2,800	68%	85%
7	Paint house -	8,000	2 weeks	2	weeks	\$8,000.00	\$8,000.00		77%	\$6,154			
Ľ		Sched	lule overrun	0.6	weeks		\$2,400.00	\$10,400	23%	\$554	-\$1,846	64%	84%
Q	Install light fixtures and appliances	9,000	2 weeks	2	weeks	\$9,000.00	\$9,000.00		71%	\$6,429			
L°		Schedule overrun		0.8	weeks		\$3,600.00	\$12,600	29%	\$1,029	-\$2,571	59%	83%
	Project planned value (PV)	128,000	40 weeks	42.4	weeks	\$128,000.00	\$137,500.00	\$137,500		\$123,065	-\$4,935	90%	96%