Suggested solutions to 3-mark and 4-mark problems contained in the Sample Paper - Exam 2
Exam 2 - Retirement Planning and Employee Benefits (RPEB)

Setion II
Question 6

A 45-year old man spends Rs. 7.5 lakh p.a., almost the amount he earns, to maintain his family. He expects his expenses to rise by 7% p.a. He has not saved for retirement. He has a second house which he wants to rent at Rs. 20,000 p.m. immediately, the rent expected to increase by 7 % p.a. You advise him to create a corpus by his age of 60 by investing the rent received in an instrument yielding 9% p.a. at the end of every year. You estimate the number of years the accumulated corpus would last taking the received rents post-retirement into account. The same is ____.

Solution:

Current expenses	750,000	Rs. p.a.	
Rate of increase of expenses	7%	p.a.	
Rent received from renting second house	240,000	Rs. p.a.	
Rate of increase of rent	7%	p.a.	
Investment yield from investing rent	9%	p.a.	
Accumulated value of investment at age 60	10,601,411	Rs.	240000*((1+9%)^15-(1+7%)^15)/(9%-7%)
Expenses required at age 60	2,069,274	Rs. p.a.	750000*(1+7%)^15
Expenses covered by rent received at age 60	662,168	Rs. p.a.	240000*(1+7%)^15
Balance expenses to be drawn from corpus	1,407,106	Rs. p.a.	2069274-662168
Number of years the corpus would last	8		NPER((1+9%)/(1+7%)-1,-1407106,10601411,0,1)
	8 years		

Setion II
Question 7

Mr. X who is 40 years old spends annually Rs. 7 lakh towards his household expenses. He expects to retire at 62 years. During this period inflation is expected to be on an average 6% p.a. He wants to cover 35 years' living expenses for self and spouse. If the inflation in the post-retirement period moderates to an average of 4% p.a. and he expects to generate a return of 7% from his accumulated corpus, what corpus should he target for a comfortable retirement?

Solution:

Current age of Mr. X	40	years	
Retirement age	62	years	
Current household expenses	700,000	Rs. p.a.	
Inflation during the pre-retirement phase	6.00%	p.a.	
Expenses expected on retirement	2,522,476	Rs. p.a.	700000*(1+6%)^(62-40)
Return expected from investing retirement corpus	7.00%	p.a.	
Inflation expected during the post-retirement phase	4.00%	p.a.	
Living expenses required for the period	35	years	
Corpus to be accumulated on retirement	56,715,821	Rs.	PV((1+7%)/(1+4%)-1,35,-2522476,0,1)
	Rs. 5.67 crore		

Setion II
Question 8

An individual has recently purchased a house worth Rs. 40 lakh for self-occupation by availing housing loan of Rs. 28 lakh at 9.25% p.a. rate of interest. The tenure of loan is 18 years. He has Rs. 12 lakh financial assets at present. He is expected to save annually Rs. 2 lakh which he investes on a quarterly basis beginning a quarter from now in an instrument which is expected to provide return of 9% p.a. What would be his net worth five years from now? The value of the house which is for consumption purposes is not considered in the net worth so arrived.

Solution:

Housing loan liability	2,800,000	Rs.	
Tenure	18	years	
Rate of interest	9.25%	p.a.	
Financial assets	1,200,000	Rs.	
Annual savings	200,000	Rs.	
Rate of investment growth in assets	9%	p.a.	
EMI on housing loan	26,659	Rs.	PMT(9.25%/12,18*12,-2800000,0,0)
After 5 years:			
Outstanding housing loan	2,414,624	Rs.	PV(9.25%/12,(18-5)*12,-26659,0,0)
Financial assets	3,082,962	Rs.	FV((1+9%)^(1/4)-1,5*4,-200000/4,-1200000,0)
Net worth of the individual after 5 years	**668,338**	Rs.	3082962-2414624

Setion II
Question 9

A 40 year old person spending Rs. 3 lakh p.a. plans to retire at age 63 and expects to live till 75 years. The basic inflation at 7% p.a. and lifestyle inflation at 1.75% p.a. are expected in the pre-retirement period. He starts investing for retirement at Rs. 30,000 p.a. in a 10% p.a. return instrument with immediate effect, and increases the contribution by 20% every year of the prior year investment amount. If the expenses post-retirement are curtailed by 20%, what maximum inflation would sustain his corpus till he survives, if the corpus is invested at 7% p.a.?

Solution:

Current age of the person	40	years	
Retirement age of the person	63	years	
Post-retirement survival period	12	years	75-63
Investment amount with immediate effect	30,000	p.a.	
Amount to be incremented every year of previous amount	20%		
Rate of return from investing towards retirement corpus	10.0%	p.a.	
Corpus to be accumulated on retirement	18,906,713	Rs.	30000*(1+10%)*((1+10%)^(63-40)-(1+20%)^(63-40))/(10%-20%)
Current expenses	300,000	Rs. p.a.	
Inflation including lifestyle inflation expected	8.75%	p.a.	
Expenses on retirement	2,065,353	Rs. p.a.	300000*(1+8.75%)^(63-40)
Curtailed expenses post-retirement	1,652,283	Rs. p.a.	2065353*(1-20%)
Expected (real) rate of return for inflation-linked annuity	0.88%		RATE(12,-1652283,18906713,0,1)
Returns from corpus post-retirement	7.00%	p.a.	
Maximum Inflation for a 12 years' inflation-linked annuity	**6.07%**	p.a.	(1+7%)/(1+0.88%)-1

Setion III
Question 4

A 55 year old individual could not save for retirement while he met his children's education and marriage. In the next 5 years he would have Rs. 35,000 per month investible surplus. The couple has household expenses of Rs. 27,000 per month. They have a second house which earns Rs. 18,000 per month in rental income. You direct their monthly savings to an 8 % p.a. instrument. Considering this return as sustainable after retirement also, inflation at 6% p.a., rental increments at 6% p.a., you estimate the period after retirement at 60 years when they may have to start curtailing their expenses. The same is _____.

Solution:

Age of the individual	55		
Present expenses	27,000	Rs. p.m.	
Investible surplus	35,000	Rs. p.m.	
Rental from second house	18,000	Rs. p.m.	
Return obtainable from investment	8.0%	p.a.	
Inflation expected	6.0%	p.a.	
Increase in rental income	6.0%	p.a.	
Corpus accumulated on retirement at age 60 years	2,569,489	Rs.	FV((1+8%)^(1/12)-1,5*12,-35000,0,1)
Expenses expected on retirement	36,132	Rs.	27000*(1+6%)^5
Rent expected on retirement	24,088	Rs.	18000*(1+6%)^5
Shortfall in expenses to be met from investment corpus	12,044	Rs.	36132-24088
Number iof months lifestyle could be maintained	259	months	NPER(((1+8%)/(1+6%))^(1/12)-1,12044,-2569489,0,1)
	21.590		;259/12
	21 years 7 months		

Setion III
Question 5

For a nominal interest rate of 10% per annum compounded monthly, quarterly, and semi-annually, the respective annual effective rates would be _____.

Solution:

Nominal rate of interest compounded monthly	10%	p.a.	
Annual effective rate of interest	**10.47%**	p.a.	(1+10%/12)^12-1
Nominal rate of interest compounded quarterly	10%	p.a.	
Annual effective rate of interest	**10.38%**	p.a.	(1+10%/4)^4-1
Nominal rate of interest compounded semi-annually	10%	p.a.	
Annual effective rate of interest	**10.25%**	p.a.	(1+10%/2)^2-1

Setion III
Question 6

A 30 years old lady plans to retire at 50. She already has financial investments amounting to Rs. 18 lakh. Her current expenses are Rs. 27,000 per month. She wants to cover 30 years post-retirement expenses inflation-adjusted by a suitable annuity. Average inflation is considered at 7% p.a. and the annuity is expected to yield 8% p.a. You advise to invest her current financial investments at 9.5% p.a. If she can incrementally invest Rs. 2.5 lakh annually, you optimize average rate of return to achieve this goal. The same is _____.

Solution:

Current age	30	years	
Retirement age	50	years	
Post-retirement period	30	years	
Current expenses	27,000	Rs. p.a.	
Rate of annuity (expected)	8%	p.a.	
Inflation rate	7%	p.a.	
Corpus needed on retirement	32,833,627	Rs.	PV(((1+8%)/(1+7%))^(1/12)-1,30*12,-27000*(1+7%)^(50-30),0,1)
Current financial investments	1,800,000	Rs.	
Rate at which these investments are parked	9.50%	p.a.	
Accumulated value of current investment on retirement	11,054,902	Rs.	1800000*(1+9.5%)^(50-30)
Balance corpus to be accumulated	21,778,726	Rs.	32833627-11054902
Annual investments to be devoted	250,000	Rs. p.a.	
Rate of return to be optimized	**12.61%**	p.a.	RATE(50-30,-250000,0,21778726,1)

Setion III
Question 7

A software profesional who retires today has two fixed life annuities, one provided by his invested pension plan at Rs. 20,000 per month and the other provided by his employer at Rs. 35,000 per month. He has a second house which currently is let out at Rs. 2.2 lakh p.a. rental. The rentals are expected to increase at 7% p.a. compounded. He currently spends Rs. 45,000 per month which will rise annually at inflation of 6 % p.a. If he invests excess amount at the end of every year in an instrument of return 8 % p.a. and utilizes this fund in case of shortfall in funding household expenses, what could be the approximate size of this fund 30 years after retirement?

Solution:

Income from fixed annuities (two)	660,000	Rs.	(20000+35000)*12
Rental income from property	220,000	Rs.	
Appreciation in rentals	7%	p.a.	
Inflation rate	6.0%	p.a.	
Investment rate for investing excess inflows	8.0%	p.a.	
Household expenses in the first year of retirement	540,000	Rs.	45000*12
PV of all monthly fixed life annuity	8,024,548	Rs.	PV(8%,30,-660000,0,1)
PV of all rental income	5,785,902	Rs.	PV(((1+8%)/(1+7%))-1,30,-220000,0,1)
PV of all monthly household expenses	12,516,264	Rs.	PV(((1+8%)/(1+6%))-1,30,-540000,,1)
Fund left behind	**12,058,286**	Rs.	(8024548+5785902-12516264)*(1+8%)^29

Setion III
Question 8

Mr. A purchased a flat worth Rs. 50 lakh in January 2007 by availing a housing loan of Rs. 35 lakh for tenure 15 years at the rate of 9% p.a. The value of his flat as in January 2013 has appreciated to Rs. 90 lakh. What approximate value of home equity can he consider in his flat towards his unencumbered interest after also setting aside 15% of the appreciation value towards taxes and other costs to be discharged on selling the unit?

Solution:

Purchase cost of flat	5,000,000	Rs.	
Loan amount	3,500,000	Rs.	
Tenure	180	months	
Rate of interest	9.00%	p.a.	
EMI	35,499	Rs.	PMT(9%/12,180,-3500000,0,0)
Installments discharged till January 2013	72		
Oustanding loan amount in January 2013	2,621,249	Rs.	PV(9%/12,180-72,-35499,0,0)
Current value of the flat	9,000,000	Rs.	
Appreciation value of the flat	4,000,000	Rs.	9000000-5000000
Amount towards taxes	600,000	Rs.	4000000*15%
Home Equity in the flat	**5,778,751**	Rs.	9000000-2621249-600000

Setion III
Question 9

Mr. A has invested annually Rs. 2 lakh towards his retirement in an aggressive fund from his age of 40 onwards. After initial high returns, the fund could generate return of just 3.5% p.a. in 10 years. He can direct a higher amount towards retirement goal in the remaining 10 years to retirement. You advise to switch half of the accumulated funds along with fresh investment in a debt fund with indicative return of 8% p.a. in the future. To achieve a target corpus is Rs. 1.2 crore, what revised amount should be invested every year if the future expectation from aggressive fund is 11% p.a.?

Solution:

Investments in aggressive fund	200,000	Rs. p.a.	
Returns obtained from aggressive fund	3.5%	p.a.	
Period of investment	10	years	
Accumulated value of investment	2,428,398	Rs.	FV(3.5%,10,-200000,0,1)
Rate of return from Debt Fund	8.0%	p.a.	
Number of further years of investment	10	years	
Initial corpus switched from aggressive fund in debt fund	1,214,199	Rs.	2428398/2
Remaining corpus in aggressive fund	1,214,199	Rs.	2428398/3
Expected return in the future from aggressive fund	11.0%	p.a.	
Accumulated corpus in aggressive fund	3,447,623	Rs.	1214199*(1+11%)^10
Total targeted corpus	12,000,000	Rs.	
Remaining to be accumulated through debt fund	8,552,377	Rs.	12000000-3447623
Fresh investments required in debt fund	(379,088)	Rs.	PMT(8%,10,-1214199,8552377,1)
	Rs. 3.79 lakh	Rs. p.a.	

Setion IV
Question 6

A person invested Rs. 45 lakh in a 30-year fixed monthly annuity providing a yield of 9% p.a. What will be the amount of monthly annuity if the start date is deferred by 3 years?

Solution:

Amount of investment	4,500,000	Rs	
Interest rate	9%	p.a.	
Deferment period	3	years	
Amount available at the time of start of annuity	5,827,631	Rs	4500000*(1+9%)^3
Period of monthly annuity	360	months	30*12
Amount per month	**45,100**	Rs	PMT((1+9%)^(1/12)-1,360,-5827631,0,1)

Setion IV
Question 7

A person at age 57 has accumulated Rs. 50 lakh towards retirement funds and opts for premature retirement. He purchases an immediate annuity for a total term of 20 years, a fixed monthly amount for the initial period of 10 years and a provision to double the monthly amount in the second 10-year period. If the minimum yield guaranteed in the annuity is 8% p.a., what monthly amount he is expected to receive in the subsequent 10-year period?

Solution:

Amount of retirement funds accumulated for annuity	5,000,000	Rs	
Total term	20	years	
Yield (minimum) expected from annuity	8%	p.a.	
Suppose the amount of monthly annuity to begin with	100	Rs.	
PV of the amount today for initial 10-year annuity	8,397	Rs.	PV((1+8%)^(1/12)-1,10*12,-100,0,1)
Monthly annuity doubles in the second 10-year; Amount	200	Rs.	
PV of the amount today for second 10-year annuity	7,779	Rs.	PV((1+8%)^(1/12)-1,10*12,-200,0,1)/(1+8%)^10
Amount required today for this arrangement	16,176	Rs.	8397+7779
Amount of monthly annuity in the initial period	30,911	Rs.	100*5000000/16176
Therefore, amount in the subsequent 10-year period	**61,821**	Rs.	30911*2