SOCIETY OF ACTUARIES
Retirement Benefits Canada – Design & Pricing, Segment B

Exam DP-RC,B

Date: Thursday, November 1, 2007
Time: 2:00 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 30 points.

   The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate Exam DP-RC,B.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

BEGINNING OF EXAMINATION
RETIREMENT BENEFITS CANADA – DESIGN & PRICING, SEGMENT B

1. *(5 points)* You are the actuary for a company that sponsors a non-contributory, defined benefit pension plan. You are given:

Plan Provisions

Retirement benefit:	2% of final salary times service
Normal retirement age:	65
Early retirement age:	55
Early retirement reduction:	0.25% per month before normal retirement age
Other ancillary benefits:	None
Normal form of payment:	Life only, payable monthly in advance

Actuarial Assumptions and Methods

Interest rate:	6% per annum
Salary increases:	4% per annum
Actuarial method:	Projected unit credit
Actuarial value of assets:	Market value of assets
Pre-retirement decrements:	None
Retirement age:	60
Funding policy:	Normal Cost plus amortization of unfunded accrued liability over 3 years, paid at the beginning of year

$\ddot{a}_{60}^{(12)} = 12$

Financial Information
Market value of assets as at January 1, 2007: $150,000

Participant data as at January 1, 2007

Employee	2007 Salary	Age	Service
A	$50,000	50	20 years
B	$30,000	30	5 years

(a) Calculate the annual contribution for 2007.

(b) During 2007 the fund earned 4%, and there were no salary increases. As at January 1, 2008 the actuarial cost method is changed to the Aggregate Method. Calculate the 2007 gains and losses and the annual contribution for 2008.

Show all work.

2. *(6 points)* Your client has a new contributory defined benefit plan for its employees. You are given:

Plan Provisions

Normal retirement age:	65
Retirement benefit:	$1,200 per year of service
Normal form of payment:	Life guaranteed 5 years, payable annually in advance
Other ancillary benefits:	None
Employee contribution rate:	$1,000 per year, payable annually in advance

Actuarial Assumptions and Methods

Date of valuation:	January 1, 2007
Interest rate:	6.5% per annum
Retirement age:	65
Pre-retirement decrements:	None
Funding policy:	Normal Cost plus amortization of unfunded accrued liability over 15 years

$\ddot{a}_{65}$	10.80
$\ddot{a}_{70}$	9.60
${}_5p_{65}$	0.93

Participant Data as at January 1, 2007

Employee	Age	Service
A	35	5 years
B	45	10 years

Determine the first year employer contribution as at January 1, 2007 under each of the following methods:

(a) Entry age normal,

(b) Individual level premium, and

(c) Frozen initial liability.

Show all work.

3. *(7 points)* You are the actuary for a company that sponsors a contributory defined benefit plan. You are given:

Plan Provisions:

Normal retirement age:	65
Early retirement age:	55
Early retirement reduction:	3% per year from normal retirement age
Normal form of payment:	Life only, payable monthly in advance
Retirement benefit:	\$50 per month per year of service
Optional forms of payment:	Actuarial equivalent using valuation assumptions

Government Benefit (Social Security Benefit):

Normal retirement age:	65
Normal form of payment:	Life only, payable monthly in advance
Normal retirement benefit:	\$3,500 per annum
Early retirement benefit:	None

Actuarial Assumptions:

Interest rate:	6% per annum

	Female	Male	Female: Male
${}_1p_{55}$	0.99	0.98	
${}_5p_{65}$	0.94	0.95	
${}_5p_{60}$	0.95	0.94	
${}_{10}p_{55}$	0.93	0.92	
${}_1q_{56}$	0.02	0.03	
$\ddot{a}_{55}^{(12)} =$	13.6	13.1	$\ddot{a}_{55:55}^{(12)} = 12.5$
$\ddot{a}_{60}^{(12)} =$	12.2	11.9	$\ddot{a}_{55:60}^{(12)} = 11.7$
$\ddot{a}_{65}^{(12)} =$	11.8	11.3	

Participant Data as at January 1, 2007:

Gender:	Female
Date of birth:	January 1, 1952
Spouse date of birth:	January 1, 1952
Date of entry:	January 1, 1990
Retirement date:	January 1, 2007
Employee contributions with interest as at January 1, 2007:	\$9,240

3. **(Continued)**

(a) Determine the monthly pension payable at retirement and at commencement of her government pension at age 65, assuming the pension will be payable under the Level Payment Social Security optional form of payment.

(b) Determine the monthly pension payable at retirement assuming a Modified Cash Refund optional form of payment.

(c) Determine the monthly pension payable under a joint and survivor optional form of payment with 60% continuing to her male spouse on her death.

Show all work.

4. *(6 points)* You are the actuary for a pension plan with only pensioners. You are given:

Plan Provisions

Form of payment:	Life only, payable annually in advance
Indexation:	Pensions increased annually effective January 1 based on inflation in the immediately preceding calendar year.

Actuarial Assumptions and Methods

Actuarial method:	Unit credit
Actuarial value of assets:	Market value of assets
Interest rate:	6.0%
Rate of inflation:	2.0%

Age	q_x	$\ddot{a}_{x(\text{inflation } 2\%)}$	$\ddot{a}_{x(\text{inflation } 1\%)}$	$\ddot{a}_{x(\text{inflation } 0\%)}$
74	0.027	9.1	8.6	8.1
75	0.031	8.7	8.2	7.8
76	0.034	8.3	7.9	7.4

Financial Information

Market value of assets as at January 1, 2007:	\$500,000
Contributions made during 2007:	\$0

Year	Pension Fund Rate of Return	Rate of Inflation
2005	8.0%	3.0%
2006	4.0%	1.0%
2007	10.0%	2.0%

Participant Data as at January 1, 2007

Pensioner	Age	Annual Pension
A	74	\$30,000
B	75	\$40,000

4. **(Continued)**

(a) Calculate the unfunded accrued liability at January 1, 2007.

(b) The plan is amended effective January 1, 2008 to change the indexation provisions to the pension fund rate of return in the immediately preceding calendar year, less 5.0%, but not less than 0%. The amendment further provides that at January 1, 2008, future pension benefit payments will be adjusted to provide the greater of the current benefit or the benefit calculated as if the new indexation formula had been in place since January 1, 2006.

There were no deaths in 2007.

Reconcile the change in unfunded accrued liability by source from January 1, 2007 to January 1, 2008.

Show all work.

5. *(6 points)* Your client has established a non-contributory defined benefit pension plan on January 1, 2007. You are given:

Plan Provisions:

Retirement benefit:	2% of final year's salary times years of service
Normal form of payment:	Life only, payable monthly in advance
Normal retirement age:	65
Other ancillary benefits:	None

Actuarial Assumptions and Methods:

Interest rate:	6% per annum
Salary increases:	4% per annum
Retirement age:	65
Pre-retirement decrements:	None
Actuarial Cost Method	Individual Aggregate (assets allocated in proportion to the prior year normal cost)
$\ddot{a}_{65}^{(12)}$	11.0

Financial Information:

There are no assets in the plan at January 1, 2007.

Participant data:

Employee	Age at January 1, 2007	Service at January 1, 2007	2007 Salary
A	50	15	$70,000
B	40	10	$50,000

(a) Calculate the normal cost as at January 1, 2007.

(b) Given the following:
- the client contributes the amount in (a) on January 1, 2007;
- the fund earns 1% during 2007; and
- the salaries increase by 4% at the end of 2007.

Determine the normal cost at January 1, 2008.

(c) Identify the sources of the change, from 2007 to 2008, in the normal cost.

Show all work.

****END OF EXAMINATION****