Institute of Actuaries of India

Subject SA3 – General Insurance

November 2013 Examinations

INDICATIVE SOLUTIONS

Solution 1:

- i) For accident years 20006/07 and earlier: case estimates For accident years 2007/08 to 2012/13:
 - O/S provision at 31/3/2013 payments since 31/3/2013 (could use actual or expected)

For the 2013/14 accident year:

- [(Earned premium to date of calc) times (Expected ultimate loss ratio)] less payments since 31/3/2013 (could use actual or expected)
- If you use actual payments, don't allow for improving or deteriorating claims experience; incurred cost for 2012/13 and earlier is zero, i.e. no impact on underwriting result; there should be some checks that actual is in line with expected (incurred cost will be affected at next valuation)
- If you use expected payments, there will be an incurred cost for 2012/13 and earlier, equal to the difference between actual and expected payments each month, i.e. underwriting result will reflect differences from month to month this may not be desirable.

(5 Marks)

ii) Accident years 2006/07 and earlier:

- estimate outstanding claims at 30/09/2013 as: case estimates at 31/03/2013 less expected payments to 30/09/2013 (CED factor adopted for valuation is 1.00, so not expecting any deterioration).
- assume all paid out in 2013/14 (consistent with ACPC projection)
- assume 50% in first half of year

So estimated O/S at 30/09/2013 = 104 - 52 = 52

Accident years 2007/08 to 2012/13:

Estimate expected payments in first half of 2013/14:

Accident year	Rs '000s	Assumed % 1st 3/12	Rs '000s
2007/08	50*3134*1.1 = 172	50%	86
2008/09	100*3127*1.1 = 344	50%	172
2009/10	250*3412*1.1 = 938	50%	469
2010/11	500*3392*1.1 = 1866	50%	933
2011/12	1000*3539*1.1 = 3893	50%	1947
2012/13	1500*3565*1.1 = 5882	50%	2941
Total	13095		6548

Expected outstanding liability at 31/03/2013:

2007/08: 172-86 = 86 2008/09: 533-172 = 361 2009/10: 1578-469 = 1109 2010/11: 3591-933 = 2658 2011/12: 8014-1947 = 60672012/13: $14763-2941 = \frac{11822}{22103}$

Accident year 2013/14:

- assume 2013/14 earned premium is 2% higher than 2012/13. So expected earned prem for 2013/14 = 28,624 x 1.02 = 29,196 (need to allow for inflation see next point)
- assume no real increase in premium rates. So expect prem rates to increase by 4% due to economic inflation. So earned prem 29,196 x 1.04 = 30,364 (half year 15,182)
- loss ratio: would increase by superimposed inflation alone, i.e. by 6%. So expect loss ratio of 1.06 times 89% (2013/14 ratio) = 94%
- expected total losses for half-year to September are then $30,364 \times 94\% \times 0.5 = 14,271$

(whole year 28,542)

- expected numbers = 3,565 (2012/13 numbers) x 1.02 = 3,636 (for full year; allows for 2% portfolio growth)
- expected payments = $3,636 \times 3,000 \times 1.1 = \text{Rs } 12\text{m}$ (for full year)
- expected payments for half year (assume 25:75) = $25\% \times 12m = Rs \ 3m$

Expected outstanding liabilities at 31/03/2013 = 14,271 - 3,000 = 11,271Total expected outstanding liabilities at 31/03/2013 = 52 + 22,103 + 11,271 = 33,426

(10 Marks)

iii) (i) First compare actual and expected claims reported and payments:

Accident year	Claim n	umbers	Claim p	Ratio	
ending March 31	Actual	Expected	Actual	Expected	A/E%
2007 and earlier	0	0	62	52	119
2008	1	0	91	86	106
2009	3	1.5	197	172	115
2010	2	3.5	499	469	106
2011	13	12	2084	933	223
2012	64	59	2098	1947	108
2013	483	450-500	3230	2941	110
2014	862	700-1000	2707	3000	90
	1428	1276-1576	10968	9600	114

Reasoning: Numbers

- Expected numbers reported for 2011/12 and earlier are 50% of full year figures from ACPC projection; assumption of 50% in first half is probably appropriate for these years
- For 2012/13, 50% won't be appropriate (projected numbers reported are changing dramatically from year to year in early dev yrs). Say 450-500.
- For 2013/14, expected number needs to take account of exposure to date: expected would be less than half of whole-year expectation (you've only had half the exposure, and there are delays in reporting). Say 700-1000.
- Conclusion on claim numbers: claim numbers are broadly in line with expectations, for all accident years.

Payments

- Expected payments are uncertain, particularly for later accident years (and very much so for 2013/2014)
- Overall, and across most accident years, payments higher than expected
- Larger than expected payments may indicate deterioration in experience, or speeding up of claim payments relative to expectations (eg. by faster finalisation than expected)
- For 2010/11, the large actual payments look like a large claim payout (see also big drop in case estimates)

Accident year	CED=(<u>CE_{end}-Payments</u>)			
ending March 31	CE begin			
	Actual	Expected		
2007 and	0.94	1.00		
earlier				
2008	0.97	1.025		
2009	1.04	1.05		
2010	1.05	1.15		
2011	1.17	1.20		
2012	1.20	1.25		
2013	1.53	1.50		

Expected values adopted

Reasoning:

- For years up to 2012/13, probably appropriate to assume that half of expected development occurs in first half of year (as above)
- For 2012/13, first half of (development) year (2) probably worse than second half, because of IBNR reports being made

Conclusion: case estimate development has been slightly better than expected across most accident years

- this may indicate speeding up of payments rather than deteriorating experience

Accident year 2013/14 experience

- Actual earned premium to date of Rs 13.9m is down on expected of Rs 15.2m.
- Incurred claim costs so far are Rs 6.9m. Compare to ultimate expected claim cost for whole year of Rs 28.5m; actual so far of Rs 6.9m looks reasonably high, considering the development expected in future loss ratio already 50%

(13 Marks)

iv) Would carry out some investigation of the historical distribution of payments between first half and second half of year (unlikely to be 50/50 in reality).

Would want more information about:

- finalisation rates (quantitative, and qualitative through discussion with claim manager)
- large claim information including payment and case estimate details
- case estimate reviews frequency and timing
- low earned premium for 2013/14: unexpected drop in business volume and/or change in average premium rate? Seasonality?

(2 Marks) [Total Marks-30]

Solution 2:

The following information should be calculated under each of the possible scenarios, to assist with providing recommendations to the Board:

- minimum capital requirement
- expected profit, expected excess capital, expected return on equity, resultant expected MCR ratio (= expected excess capital divided by MCR).
- expected profit at 80% level, excess capital at 80% level, MCR ratio at 80% level
- expected profit at 95% level, excess capital at 95% level, MCR ratio at 95% level

Note that it is not possible for you to assess the Board's requirement that there be no chance of the MCR ratio being less than 100%. Given the nature of insurance business, certain solvency cannot be guaranteed. However, looking at the 95% level expectations will assist in advising the Board on the likelihood of solvency being breached. Note that whilst return on equity is not required to be calculated in order to assess the likelihood of each of the Board's risk requirements being met, it is an important consideration in advising on the overall decision the Board should make, as the Board is of course driven by profit maximisation, given their risk constraints.

Calculations, Scenario 1: Current reinsurance arrangements, no dividend payout.

This is the current status quo. MCR therefore remains at 100 million.

Expected loss ratio	= 95.2% (after expenses)	(=70.2%+25%)
Expected profit	= Rs 24M	(= 4.8% of Rs 500M, assuming zero tax)
Expected excess capital	= Rs 224M	(= current excess capital plus expected profit)
Expected MCR ratio	= 224%	
Expected return on equity	= 12%	(=profit / starting excess capital)
80% probability level		
loss ratio	= 103.3% (after expenses)	(=78.3%+25%)
Profit	= -Rs 16.5M	(= -3.3% of Rs 500M, assuming zero tax)
Excess capital	= Rs183.5M	(=current excess capital plus expected profit)
MCR ratio	= 183.5%	
95% probability level		
loss ratio	= 112.7% (after expenses)	(=87.7%+25%)
Profit	= -Rs 63.5M	(= -12.7% of Rs 500M, assuming zero tax)
excess capital	= Rs136.5M	(=current excess capital plus expected profit)
MCR ratio	= 136.5%	

Calculations, Scenario 2: Current reinsurance arrangements, with Rs50M dividend payout.

MCR remains at 100 million as no changes have been made to the reinsurance arrangements.

Loss ratio & profit figures remain unchanged from above. Expected excess capital is Rs 50M lower than scenario 1 calculations due to effect of dividend.

Expected excess capital = Rs 174MExpected MCR ratio = 174%Expected return on equity = 16%

80% probability level [1]

excess capital = Rs 133.5M MCR ratio = 133.5%

95% probability level [1]

excess capital = Rs 86.5M MCR ratio = 86.5%

Calculations, Scenario 3: New reinsurance arrangements, no dividend payout

As the reinsurance arrangements have changed, the insurer will be exposed to a maximum Rs50M for any one event, up Rs20M from its previous exposure. The effect of the new reinsurance arrangements directly affects the Maximum Event Retention, which forms part of the overall calculation of the Minimum Capital Requirement.

The maximum event retention also includes allowance for the cost of one reinstatement, however given both the old and new reinsurance proposals allow for two free reinstatements, this can be ignored.

Therefore, the MER will increase by Rs20M, and the MCR will also increase by Rs20M, to Rs120M.

Expected loss ratio = 93.1% (after expenses) (= 68.1%+25%)

Expected profit = Rs 34.5M (= 6.9% of Rs 500M,

assuming zero tax)

Expected excess capital = Rs 234.5M Expected MCR ratio = 195% Expected return on equity = 17.25%

80% probability level [1 mark]

loss ratio = 116.2% (after expenses) (=91.2%+25%)

Profit = -Rs 81M (= -16.2% of Rs 500M,

assuming zero tax)

excess capital = Rs119M MCR ratio = 99%

95% probability level [1 mark]

Profit

loss ratio = 157.5% (after expenses) (=132.5%+25%)

= -Rs287.5M

(= -57.5% of Rs 500M,

assuming zero tax)

excess capital = -Rs87.5M MCR ratio = -73%

Given solvency is not even met under scenario 3, there is little point in calculating the other possible scenario, being both new reinsurance arrangements and dividend payout.

Recommendation to the Board

As requested, I have evaluated the current arrangements and the two alternate proposals presented to the Board, in light of the Board's risk objectives and current capital position.

I have examined three scenarios for consideration by the Board. These scenarios are as follows:

Scenario 1: Current reinsurance arrangements, no dividend payment

Scenario 2: Current reinsurance arrangements, Rs50M dividend payment

Scenario 3: New reinsurance arrangements (cat cover of Rs100M XS Rs 50M), no dividend payment.

I have examined each of these three scenarios by their ability to meet the following objectives:

Objective 1: Target MCR ratio of 150% (where MCR ratio = excess capital divided by MCR)

Objective 2: 80% probability of MCR ratio exceeding 120%

Objective 3: 95% probability of MCR ratio exceeding 100%

Objective 4: Maximising return on equity

I note that one of the Board's stated objectives was that the company was not to risk having an MCR ratio less than 100%. Given the nature of insurance business, certain solvency cannot be guaranteed, however we have presented the MCR ratio at 95% probability as a useful guide.

The results of my analysis are presented in the following table:

Accident year	Scenario 1	Scenario 2	Scenario 3
Target MCR ratio of 150%	224%	174%	195%
80% prob MCR ratio > 120%	183.5%	133.5%	99%
95% prob MCR ratio > 100%	136.5%	86.5%	-73%
Expected RoE	12%	16%	17.25%

Under the current reinsurance arrangements with no dividend payout (scenario 1), all of the Board's stated risk objectives are likely to be met. The insurer however is excessively capitalised, as even at the 95% probability level, the insurer will have sufficient funds to ensure an MCR ratio of 136.5%, well above the 100% minimum requirement. A return of 12% is likely to be achieved under the continuation of the existing arrangements.

If a dividend payout of Rs 50M is made (scenario 2), then the insurer will continue to meet two of its stated risk objectives, however there is a greater than 5% chance that it will have an MCR ratio of less than 100% (and will therefore fail to meet the regulator's minimum capital requirements). The reduction in capital level will result in a higher return on capital, of around 16%. The insurer's Board needs to consider whether it is prepared to accept a greater than 5% risk of not meeting MCR, for the sake of the additional 4% expected return on capital.

Under the proposed changes to the catastrophe reinsurance cover (scenario 3), the insurer will only meet one of its stated risk objectives. There is a greater than 20% chance that the insurer will not have sufficient capital to meet the regulator's minimum capital requirements. In addition, there is a greater than 5% chance that the insurer will become insolvent. This seems a high risk to take, for the sake of an additional 1.25% return on capital.

Given the above analysis, I recommend that the insurer consider keeping its existing reinsurance arrangements. In order to maximise return on capital, I recommend that the Board consider paying a small dividend to shareholders. If a Rs50M dividend is paid, there will be a greater than 5% chance that the regulator's MCR will be breached. A smaller dividend payout of, say, Rs 25M would reduce the probability of not meeting the regulator's MCR requirements to less than 5%. (This is calculated by adding Rs 25M to the calculated excess capital of Rs 86.5M at the

95% probability level. This gives an MCR ratio of just over 100% at the 95% level).

(20 Marks)

Solution 3:

i) Employers' Liability

A very large number of employees/volunteers will be working at the sports stadiums and the promotion events; likelihood of bodily injury claims from accidents.

Public Liability

A large number of spectators for the games and the promotion events so possible claims for slips/trips or more significant injuries following stampedes. Also claims for damage/theft of property from negligence of organisers.

Financial Protection

Losses could arise from non-performance/insolvency of subcontractors or from the failure of a commercial sponsor of the event.

Similarly lack of approval for the games and/or promotion events from the local authorities can cause a major financial loss to the organisers.

Directors & Officers

Significant claims can arise against the organisers for maladministration of the games and promotion events.

Construction/Engineering

If organiser is responsible for construction of venues, likely to be claims for damage/delay to unfinished stadia.

Commercial Property

Losses can arise from:

- fire and perils including malicious damage, theft;
- catastrophe losses from weather event e.g. flood; and
- · terrorist attacks.

Contingency/Event Cancellation

Non-appearance of musicians, film stars and sport legends at concert could lead to significant losses if games or promotion events get cancelled to the sponsors.

Motor

Both bodily injury and property damage claims could arise as the organisers are likely to operate motor fleet.

PD claims small, consistently distributed, injury claims subject to delays but less so than EL.

Competitors PA, Travel & Belongings Cover

Fixed benefit for athletes competing at premier league games and other musicians/film stars/sport legends.

Amounts high depending on game/musical concert and extent of the athlete/film star/musician's earnings

Goods In Transit

Covers for delivery of merchandised items/equipment to venues around the country.

Possibility of moral hazard if economic conditions worsen.

Product Liability

Indemnifies against loss caused by defect in any premier league branded merchandise

Computer Cover

Indemnifies against loss caused by virus/criminal hacking of the event website

..or losses arising from failure of event-booking engine

Fidelity Guarantee/Pecuniary Loss

Loss caused by theft/criminal act of employee

Credit Insurance

The promoter may have raised a lot of loans for the event, credit insurance will cover the risk of inability of paying the loans.

(8 Marks)

ii) General points

It may want to price each individual event separately to take account of the risks for each venue specifically including expected weather conditions.

Or it may set a price to cover the whole season, up to a specified number of events and entrants.

The amount of cover will be related to the number of events and the size/scale of the game or the promotion event i.e. the number of participants and the entry fee.

This being an 'All Risks' type of cover and a multi-year agreement with annual premium payments, the pricing needs to take care of any inflation of all insurance cash flows.

This type of insurance cover is not common and hence the availability of in-house data may be limited; the insurer will have to rely on similar events cover as proxy or approach the reinsurers for assistance.

Risk premium

Rating factors – look at similar adverse weather policies (e.g. pluvius insurance), written by other companies or reinsurers, to see what types of rating factors are used (if any).

Look at any previous claims experience available from IPL or music concerts.

Adjust the experience to the projected period of exposure.

It will need to consider frequency and severity separately.

...because they are influenced by different factors.

Frequency

It needs to consider likely weather patterns for the date(s) of the event(s), and the likelihood of the weather being severe enough to cause a problem.

In order to arrive at this, it can use a blend of relevant experience and judgement.

Relevant experience could come from similar covers from other developed countries, weather-related data and the reinsurers.

The judgment element may require help from relevant experts e.g. weather scientists.

This will be very difficult to predict.

and so may be covered by a contingency margin (implicit or explicit) rather than a specific loading to the premium.

It may need to take into account the non-independence of weather events from

one day to the next ...

... for example, if a storm/flood occurs then it might clear up in a couple of days

whereas a freeze event could last for weeks.

Severity

This will depend on the amount of cover provided.

e.g. maximum limits, excesses, exclusions (or other example)

- \bullet likely to be determined by the expected number of events \times average expected number of participants x the known entry fee
- plus loadings to cover additional lost revenue
- · or based on expenses incurred
- or on historic profit per event

We should allow for seasonality e.g. not as any participants during the monsoon

months (or other sensible example)

We can ignore discounting because this is short-tailed business.

Other loadings

Expenses

- consider the likely marginal costs associated with writing this business, especially the additional costs of consulting with weather experts for each event and an allowance for contribution to overheads.

Commission

– as this will be sold via the Lloyd's broker that approached us.

Profit (and contingencies)

- there is a lot on uncertainty attached to pricing this business so we might want relatively high profit loadings.

Adjust as necessary to reflect any existing relationship with the broker or insured (or cross-selling opportunity).

Competition – if there are any other insurers writing this business, or quoting for this particular contract then we would need to take account of their rates.

Reinsurance – any costs of including this class within the reinsurance cover.

Capital charge to reflect cost/availability of capital ...

... and accumulation/diversification with other UK weather risks in the portfolio e.g. property insurance.

Allow for investment income, if any.

Allow for any premium levies.

Add any premium tax.

Allow for any element of experience rating in the policy.

Allow for an adjustment premium to reflect a different number of entrants from that assumed.

(15 Marks)

iii) Risk or Event Excess of Loss Reinsurance to cover the following:

Employers' Liability

Bodily injury claims of various sizes depending on nature of accident.

These could be very large e.g. in the event of the permanent disablement of a high earning employee.

Injury claims can take a long time to settle due to litigation/medical evidence.

May be reporting delays as the injury may not deteriorate for some time and therefore the claims cost will be impacted by level of inflation

Public Liability

Large number of spectators for the games and the promotion events so possible claims for slips/trips or more significant injuries following stampedes.

Frequency may be expected to be higher than for EL as a very large number of spectators expected.

Also claims for damage/theft of property from negligence of organisers.

Very large number of employees/volunteers/spectators at the same venue – possibility of accumulation of injury claims from EL, PL and PA.

Competitors PA

Amounts high depending on game/musical concert and extent of the athlete/film star/musician's earnings.

Product Liability

Directors & Officers

Likely to be large and potentially notified long after the event.

Motor

Bodily injury claims could be large especially during bad weather conditions.

Commercial Property

Significant potential for terrorist attack as high profile event – could give rise

to significant damage/injury claims especially if negligence proved

Fire and non-weather perils including theft and malicious damage

Business Interruption

Consequential losses from any damage to the stadia, belongings, etc.

Contingency

Sponsors losing revenue from events from non-appearance of musicians, film stars and sport legends at concert could lead to significant losses if event cancelled

Additional costs of making refunds

Financial Protection

Losses could arise from non-performance/insolvency of subcontractors

Or the failure of a commercial sponsor of the event

Potential could be very large and lead to lengthy legal actions as contracts

likely to be complex

Construction

Damage/delay to unfinished stadia may give rise to cancellation of events which could rise to 'Contingency' described above.

Competitors Belongings Cover

Goods In Transit (damage due to weather, accidental damage as well as theft)

Computer Cover (hacking events)

Fidelity Guarantee

Catastrophe Reinsurance Cover per event as well as an aggregate cover to cover the following:

Commercial Property

Potential for catastrophe losses from weather event e.g. flood.

Business interruption

Losses can be significant if the event gets cancelled because of weather and consequential damage to the stadia.

Damage to the Motor fleet

Belongings Cover of Athletes/Musicians/Film Stars, etc.

(7 Marks)

[Total Marks-30]

Solution 4:

i)

-/									
	Year	Vehicle years	Claims cost (Rs. In Lakhs)	Large Claims	Large Claims capped to Rs. 1 Lakh	Adj for Large Claims	Claims Inflation Factor	Develop ment Factor	Claims cost after inflation & devmt factors
	[1]	[2]	[3]	[4]	[5]	[6] = [3] - [4]	[7]	[8]	[9] = [6] *
						+ [5]			[7] * [8]
	2013	600							
	2012	500	121.60	0.00	0.00	121.60	1.0600	1.5	193.34
	2011	450	126.00	1.75	1.00	125.25	1.1236	1.4	197.02
	2010	350	93.40	0.00	0.00	93.40	1.1910	1.3	144.61
	2009	340	115.40	5.00	2.00	112.40	1.2625	1.2	170.28
_	2008	330	94.40	0.00	0.00	94.40	1.3382	1.1	138.96
		1,970		6.75	3.00				844.22
	Average claims cost per vehicle-year using the last 5 years experience 42,854.04								42,854.04
	Spread the large claims cost (in excess of Rs. 1 Lakh) over all years = 190.36 = (6.75 - 3.00) * 1,00,000/1,970								190.36
Risk premium (based on the fleet's experience) = 42,854.04 + 0.75 = 43,								43,044.40	
	Premium after applying 6% claims inflation for 2013 and loading of $15\% = 52,475$ = $43,044.40 * 1.06 * 1.15$								52,471.12

After applying a credibility factor of 0.65 to the fleet's claims experience,

Total Premium expected using 600 vehicle-years = 48,106.23 * 600 =

= 52,471.12*0.65+40,000*0.35

(8 Marks)

28,863,738

48,106.23

ii) Formula to use is

$$SM(1) = SM(0) (1 + i(1-t)) + R(1)(1-t)(1-d)$$

- SM(x) =solvency margin at time x
 - R(x) is the gross insurance profit as a percentage of gross written premium in the period x- 1 to x
 - P(x) is gross written premium in period x- 1 to x
 - *i* is the gross rate of interest
 - *t* is the rate of taxation
 - d is the percentage of the net insurance profit after tax which is distributed as dividend

So here

$$0.30P(1) = 0.3P(0) (1 + .08 * .65) + R(1) * .65 * .80$$

 $0.30P(1) = 0.15P(1) (1.052) + R(1) .52$
 $R(1) / P(1) = 27.3\%$ (3 Marks)

iii) Solvency Ratio under three scenarios are:

$$A*(1+100\%)*P(0) = 0.3P(0) (1 + .08 * .65) + 0.08 * P (0) * .65 * .80$$

$$A = 0.3572/2 = 0.1786$$

$$B*(1+120\%)*P(0) = 0.3P(0) (1 + .08 * .65) + 0.07 * P (0) * .65 * .80$$

$$B = 0.352/2.2 = 0.16$$

$$C*(1+40\%)*P(0) = 0.3P(0) (1 + .08 * .65) + 0.12 * P (0) * .65 * .80$$

$$C = 0.378/1.4 = 0.27$$

When fuel subsidies are rolled back, the fuel prices in the market will increase and will give rise to inflation and contraction in the market.

If the current deficit is high, the currency will weaken which will result in the cost of imports increasing.

Import controls of any kind will result in increase in claims – costs of spare parts increasing as well as new vehicles (when completely written-off) will cost more.

Similarly if the excise duty increases, both the costs of spare parts and new vehicles will cost more which would result in increase in the cost of claims.

If the cost of claims is significantly different to the risk premium basis calculations on which the new business is being written, this will result in underwriting losses and the company may not be able to meet the net profit and hence keep up with the expected dividends to its shareholders. This would affect both the rating and future growth capabilities of the company.

All austerity measures will result in the contraction of the economy; there will be less demands or growth in the movement of goods and hence fleet business.

Similarly, austerity measures may result in falling incomes as well as loss of confidence for consumer spending; this again decrease the movement of goods and hence reduction in fleet business.

Historically, the Government of India has been keeping the interest rates very high in order to contain inflation. Higher interest rates likely to result in less consumer demand for fleet business.

Any reduction in the movement of goods and fleet traffic, on the other hand, may result in reduction in claims. This normally does not result in increase in profits as they are usually experience-rated with return of premium or reduction in premium for the following year.

Looking at the projected solvency ratios under 3 scenarios above, the growth plans under A and B will significantly reduce the solvency ratio from the current level of 30%. This could lead to a higher degree of intervention from the regulators as well as market pressures (rating agencies, press, brokers, reinsurers, etc.). This may rise to pressure on future growth plans including rising monies in the future.

(9 Marks)

[Total Marks-20]
