

FREEFELLOW

FORMULA SHEET

CAS-EXAM6U

72

FORMULAS

8

TOPICS

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REGULATION FOUNDATIONS & THE NAIC1 item	
Risk-Based Capital ratio $\text{RBC ratio} = \frac{\text{TAC}}{\text{ACL RBC}}, \text{ TAC} = \text{total adjusted capital, ACL RBC} = \text{Authorized Control Level risk-based capital}$	
SOLVENCY, SPECIALTY MARKETS & EMERGING REGULATION7 items	
Total Adjusted Capital $\text{TAC} = \text{PHS} - D_{nt} - D_t, \text{ PHS} = \text{policyholders' surplus, D}_{nt} = \text{non-tabular discount, D}_t = \text{tabular discount on medical reserves}$	Authorized Control Level RBC $\text{ACL RBC} = 0.5 \times (\text{RBC}_{\text{cov}} \times 1.03), \text{ RBC}_{\text{cov}} = \text{covariance result, 1.03 applies the 3\% basic operational risk add-on before halving}$
Risk-based capital covariance result $\text{RBC}_{\text{cov}} = R_0 + \sqrt{R_1^2 + R_2^2 + R_3^2 + R_4^2 + R_5^2 + R_{\text{cat}}^2}, \text{ RO} = \text{affiliate risk, R1-R5} = \text{fixed income/equity/credit/reserving/premium risk, Rcat} = \text{catastrophe risk}$	Surplus lines premium tax (home state, NRRRA) $T = P \times t, \text{ T} = \text{tax owed to insured's home state, P} = \text{full policy premium, t} = \text{home-state surplus lines tax rate (no multi-state allocation)}$
Acceptable predictive rating factor gate $A = S \wedge C \wedge \neg P, \text{ A} = \text{acceptable factor, S} = \text{statistically significant, C} = \text{cost-rational link, P} = \text{proxy for a protected class}$	Price-optimized premium $P_{\text{opt}} = R \times m, \text{ P}_{\text{opt}} = \text{optimized premium, R} = \text{cost-based indicated rate, m} = \text{demand/elasticity multiplier (m>1 for inelastic insureds)}$
Cost-based indicated rate $R = \frac{PP}{1 - V}, \text{ R} = \text{indicated rate, PP} = \text{expected pure premium, V} = \text{combined expense-and-profit load (as a fraction)}$	
TORT ENVIRONMENT & GOVERNMENT PROGRAMS14 items	
Total insurer retention under TRIA $R = D + 0.20(L - D), \text{ R} = \text{insurer retention, D} = \text{deductible (20\% of prior-year premium), L} = \text{insured loss}$	Subsidy per insured $S_i = P_i^{rb} - P_i^c, \text{ S}_i = \text{subsidy for insured i, P}_i^{rb} = \text{risk-based premium, P}_i^c = \text{charged premium}$
Treasury mandatory recoupment under TRIA $RC = 1.40 \times F, \text{ RC} = \text{amount recouped via policyholder surcharges, F} = \text{federal outlay (applies below the \$37.5B aggregate retention)}$	Residual-market deficit recoupment surcharge rate $s = \frac{A}{VP}, \text{ s} = \text{surcharge rate, A} = \text{assessment owed (market share} \times \text{deficit), VP} = \text{insurer's voluntary premium base in the line}$
Total tort cost breakdown $C_{\text{total}} = C_{\text{net}} + C_{\text{plaintiff}} + C_{\text{defense}} + C_{\text{admin}}, \text{ C}_{\text{net}} = \text{claimant net compensation, C}_{\text{plaintiff}} = \text{plaintiff legal costs, C}_{\text{defense}} = \text{defense costs, C}_{\text{admin}} = \text{administrative overhead}$	Post-reform award with cap and collateral source offset $A = (E - O) + \min(N, K), \text{ A} = \text{post-reform award, E} = \text{economic damages, O} = \text{collateral source offset, N} = \text{non-economic damages, K} = \text{non-economic cap}$
Defendant liability under modified joint-and-several reform $L_d = A \times f_d, \text{ L}_d = \text{amount owed by the defendant, A} = \text{total post-reform award, f}_d = \text{defendant's fault share}$	TRIA federal reimbursement (federal share) $R = 0.80 \times (L - D), \text{ } L > D, \text{ R} = \text{federal reimbursement, L} = \text{insurer's certified losses, D} = \text{insurer deductible}$
TRIA insurer deductible $D = 0.20 \times P, \text{ D} = \text{insurer deductible, P} = \text{prior-year direct earned premium in TRIA-eligible commercial P\&C lines}$	TRIA insurer retention $I = D + 0.20 \times (L - D), \text{ } L > D, \text{ I} = \text{insurer retention, D} = \text{insurer deductible, L} = \text{insurer's certified losses}$
Three-year survival ratio $\text{Survival ratio} = \frac{\text{Reserves}}{\frac{1}{3} \sum_{t=1}^3 \text{Paid}_t}, \text{ Reserves} = \text{current held reserves, Paid}_t = \text{paid loss in each of last 3 years}$	Change in policyholder surplus from reserve strengthening $\Delta \text{Surplus} = - \Delta \text{Loss Reserves}, \text{ } \Delta \text{Surplus} = \text{change in policyholder surplus, } \Delta \text{Loss Reserves} = \text{change in loss-reserve liability}$
Pro-rata by time on risk allocation share $\text{Insurer share} = \frac{y}{T} \times L, \text{ y} = \text{years insurer covered, T} = \text{total trigger period in years, L} = \text{total indemnity loss}$	Program funding adequacy ratio $\text{Funding ratio} = \frac{\text{Premium} + \text{Reserves} + \text{Backstop}}{\text{Expected losses} + \text{Cat load}}, \text{ ratio} \geq 1 \text{ means the program self-funds an average year; exclude any backstop drawn every year}$

PRIMARY STATEMENTS & STATUTORY ACCOUNTING		8 items
Solvency II risk margin $RM = CoC \sum_{t \geq 0} \frac{SCR_t}{(1+r_{t+1})^{t+1}}$, RM = risk margin, CoC = cost-of-capital rate (6%), SCR_t = projected solvency capital requirement at time t, r = risk-free rate	Solvency II technical provision $TP = BE + RM$, TP = technical provision, BE = best estimate (probability-weighted PV of future cash flows at risk-free rates), RM = risk margin	
GAAP equity bridge from SAP surplus $E_{GAAP} = S_{SAP} + DAC + NA + AFS + DTA$, E = GAAP equity, S = SAP surplus, DAC = unamortized deferred acquisition costs, NA = nonadmitted assets, AFS = AFS fair-value gain, DTA = additional deferred tax asset	IFRS 17 insurance liability $L = PV(CF) + RA + CSM$, L = insurance liability, PV(CF) = present value of fulfilment cash flows, RA = risk adjustment for non-financial risk, CSM = contractual service margin (unearned profit)	
Combined ratio $CR = \frac{Loss}{EP} + \frac{LAE}{EP} + \frac{UW\ expense}{WP}$, Loss = incurred loss, LAE = loss adjustment expense, EP = earned premium, WP = written premium; below 100% = underwriting profit	Capital and surplus account roll-forward $S_{end} = S_{beg} + NI + \Delta U + \Delta T + \Delta N - \Delta R - D + C$, NI = net income, ΔU = Δ unrealized gains, ΔT = Δ net deferred tax, ΔN = Δ (decrease in) nonadmitted assets, ΔR = Δ reinsurance provision, D = stockholder dividends, C = paid-in capital	
Statutory policyholders' surplus Surplus = Admitted assets – Liabilities, Admitted assets = readily marketable assets (nonadmitted excluded); Liabilities = total statutory liabilities	Statutory underwriting income $UW\ income = EP - Loss - LAE - UW\ expense$, EP = earned premium, Loss = incurred loss, LAE = loss adjustment expense, UW expense = other underwriting expense	

ANNUAL STATEMENT SCHEDULES & THE IEE		4 items
IEE investment gain allocated to a line $IG_{line} = y \times (\overline{R}_{L+LAE} + \overline{UEPR} - \overline{AB})$, y = investment yield, mean loss/LAE reserves, mean unearned premium reserve, mean agents' balances	One-year reserve development $D_1 = (P_{yr} + R_{now}) - R_{prior}$, P_{yr} = paid this year on all prior accident years, R_{now} = reserves now held on those years, R_{prior} = reserves held one year ago; positive is adverse	
IRIS ratio 11 one-year reserve development to surplus $IRIS\ 11 = \frac{D_1}{S}$, D_1 = one-year reserve development on all prior accident years, S = policyholders' surplus; unusual value if exceeds 20%	Schedule F provision for reinsurance $Provision = (R - C) + 0.20 \times O$, R = unauthorized recoverable, C = collateral held, O = over-90-day overdue amount (penalty only if $O > 20\%$ of that reinsurer's total)	

SOLVENCY METRICS: RBC & IRIS

6 items

THE APPOINTED ACTUARY: SAO, AOS & PROFESSIONALISM

10 items

Materiality standard as a percentage of surplus $M = p \times S$, M = materiality standard, p = chosen percentage (e.g. 10%), S = statutory policyholders surplus	Reserve deficiency below the range of reasonable estimates $D = L - C$ when $C < L$, D = deficiency (inadequate opinion), L = low end of reasonable range, C = carried reserve
AOS adverse one-year reserve development disclosure trigger $\frac{\text{Adverse 1yr development}}{S_{prior}} > 5\%$ in ≥ 3 of past 5 years, S_prior = prior year-end surplus; triggers required AOS explanation of contributors	Risk of material adverse deviation test $(H - C) > M \Rightarrow$ RMAD exists, H = high end of reasonable range, C = carried reserve, M = disclosed materiality standard (gap at or below M does not rule out RMAD)
ASOP 36 risk of material adverse deviation bright-line test $\text{Carried} + M \in [\text{Low}, \text{High}] \implies$ RMAD exists, M = materiality standard, Low/High = ends of actuary's range of reasonable estimates	AOS one-year adverse development disclosure threshold $D_t > 0.05 \times S_{t-1}$, D_t = one-year adverse development in year t, S_{t-1} = that year's prior year-end policyholders' surplus
Reasonable reserve provision condition $\text{Carried} \in [\text{Low}, \text{High}]$, Carried = carried reserves, Low = low end of range, High = high end of actuary's range of reasonable estimates	Risk of material adverse deviation condition $\text{RMAD present} \iff D > M$, D = plausible adverse deviation from major risk factors, M = materiality standard
AOS persistent adverse-development disclosure trigger Describe if $\frac{AD_t}{S_{t-1}} > 5\%$ in ≥ 3 of last 5 years, AD = one-year adverse development, S = prior year-end surplus	Materiality standard for the SAO $M = p \times S$, M = materiality standard, p = selected percentage (e.g. 10%), S = policyholders' surplus

INSURER TAXATION & REINSURANCE ACCOUNTING		22 items
Expected reinsurer deficit $ERD = p \times \bar{s}$, p = probability of an NPV loss to the reinsurer, $\bar{s}$ = average loss severity as a percent of premium; risk transfer indicated when ERD > 1%	Reinsurer present-value loss as a percent of premium $L\% = \frac{PV(\text{losses} + \text{expenses}) - P}{P}$, PV = present value of losses and expenses in a scenario, P = reinsurance premium paid	
Ten-ten rule risk transfer condition $\Pr(L\% \geq 10\%) \geq 10\%$, $L\%$ = reinsurer PV loss as a percent of premium; both a 10% probability and a 10% loss size are required to pass	Slow-paying test ratio on paid recoverables $\text{ratio} = \frac{OP}{TP+RP} \geq 0.20$, OP = paid recoverables over 90 days overdue not disputed, TP = total paid recoverables not disputed, RP = amounts received in prior 90 days	
Provision for unauthorized reinsurance $P = \min[(R - C) + 0.20 \times OD, R]$, R = recoverable, C = collateral held, OD = overdue or disputed amount, P = provision (capped at R)	Below-the-line overdue and disputed provision $P = 0.20 \times (OP + D)$, OP = overdue paid balances, D = disputed paid balances, P = provision charged when reinsurer is not slow-paying	
Slow-paying reinsurer provision $P_{slow} = 0.20 \times \max(R - C, OP)$, R = recoverable, C = funds held plus collateral, OP = paid recoverables over 90 days overdue, P = provision	Proration reduction to the loss deduction $\Delta = p(TEI + DRD)$, p = reduction percentage = 5.25%/21% = 25%, TEI = tax-exempt interest, DRD = dividends-received deduction; reduces losses incurred	
Tax loss reserve discount amount $D = R_{undisc}(1 - f)$, R_{undisc} = statutory undiscounted reserve, f = discount factor = $R_{disc}/R_{undisc} \leq 1$; D is added to current taxable income	Tax-earned premium under the revenue offset $EP_{tax} = WP - 0.80 \Delta UEPR$, WP = written premium, $\Delta UEPR$ = increase in unearned premium reserve; equals statutory earned premium plus 20% of $\Delta UEPR$	
Discounted unpaid loss reserve under Section 846 $R_{disc} = \sum_t P_t (1 + i)^{-(t-0.5)}$, P_t = payment at time t, i = prescribed discount rate, t = full years from valuation, 0.5 = mid-year convention	Reinsurer maximum present-value loss ratio $\ell = \frac{L_{max}}{\text{Prem}}$, ℓ = worst-case loss as fraction of premium, L_{max} = maximum present-value loss to reinsurer, Prem = ceded premium; significant if $\ell \geq 10\%$	
10-10 rule risk transfer screen $P(L \geq 0.10 \times \text{Prem}) \geq 0.10$, L = reinsurer present-value loss, Prem = ceded premium; at least a 10% probability of at least a 10% PV loss	Net consideration booked as a deposit $D = \text{Prem} - C$, D = deposit (asset for cedant, liability for reinsurer), Prem = premium paid, C = ceding commissions; carried forward at the effective yield	
Reinsurance accounting qualification condition Reinsurance accounting = $R_{ins} \wedge S_{loss}$, R_{ins} = significant insurance risk transferred, S_{loss} = reasonable possibility of significant loss; both must hold or use deposit accounting	Surplus relief from ceding a quota share $\text{Surplus aid} = c \times \text{UPR}_{ceded}$, c = ceding commission rate, UPR_{ceded} = ceded unearned premium reserve	
Surplus aid as a percent of policyholders' surplus $\text{Surplus aid } \% = \frac{c \times \text{UPR}_{ceded}}{\text{Surplus}}$; 15% or more trips the IRIS Ratio 4 unusual value	Net premium-to-surplus leverage $\text{Net leverage} = \frac{\text{NWP}}{\text{Surplus}}$, NWP = net written premium (net of ceded), Surplus = policyholders' surplus	
Taxable gain on a commutation under IRC 846 $G_{tax} = R_{tax} - P$, G_{tax} = taxable gain, R_{tax} = IRC 846 discounted reserve released, P = commutation payment	Reinsurer statutory gain on a commutation $G = R_{released} - P$, G = reinsurer gain, $R_{released}$ = assumed statutory reserves released, P = commutation payment made	
Book-tax difference on a commutation gain $\Delta = R_{stat} - R_{tax}$, Δ = book-tax difference (equals reserve discount), R_{stat} = statutory reserve, R_{tax} = IRC 846 discounted reserve	Cedant underwriting result on a commutation $U = P - C$, U = cedant result (loss if negative), P = commutation cash received, C = recoverable the cedant carried	