Paper: CCIR.ARinstr (Alphabet City (Model 18.F Q16)) ExamQ a-Question
Problem: calculate (A,B,C,D,E,F,G,H,J,K) - there is no "I"
Problem Type: 2018.Fall #16

Balance Sheet

Page 20.10 Asset	2017	2016	
recoverable from reinsurers:			
UEP	n/a	1,200	<== ceded values
UCAE	A	1,760	<== ceded values
total investments including cash	30,000	25,000	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	3,000	<== gross values
UCAE	B	4,477	<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	16,000	15,000
NEP	15,800	n/a
GROSS claims & adjustment expenses	C	n/a
REINSURER'S SHARE of claims & adj exps	D	n/a
NET claims & adjustment expenses	E	n/a
NET investment income	1,800	n/a

Runoff

CY	Page 60.41 Net Clms & Adj Exps Runoff Discounted		AY 2016	AY 2017	AY 2017 & prior
2016	UCAE	end of year	1,200		
	IBNR	end of year	1,517		
2017	Paid	*during year*	F	n/a	n/a
	UCAE	end of year	900	n/a	2,100
	IBNR	end of year	1,159	n/a	K
	investment income from UCAE & IBNR		G		
	Amount:	*excess/deficiency*	n/a		
	Ratio:	*excess/deficiency*	H		

Bond Portfolio

rating	class	book val.	mkt. val.	duration	yield
govt	HTM	2,000	1,000	0.8	1.0%
AAA	HTM	8,000	8,000	10.0	2.0%
A	HTM	15,000	17,000	3.0	3.0%

Triangle Data

GROSS paid loss (cumulative)

AY	12	24
2016	1,000	3,000
2017	1,000	

GROSS unpaid loss (undiscounted)

AY	12	24
2016	n/a	3,000
2017	4,000	

Payment Pattern *(incremental)*

year 1	20%
year 2	30%
year 3	50%

MfADs

MfAD (claims):	15.00%
MfAD (re):	2.00%
MfAD (inv):	0.75%

* reinsurance quota-share RETENTION ==> **60%**

Step 1: calculate the discount rate as a weighted average of the yields in the bond portfolio

weight *	yield	
1,600	1.0%	
80,000	2.0%	
45,000	3.0%	
	2.34%	<== discount rate

* weight = (book value) x duration

Step 2a: calculate the gross PV for AY 2017 and AY 2016 *(gross of quota-share reinsurance)* at **2.34%**

AY 2017:	unpaid	=	4,000	*(at 12 months)*						
	PV_{17}	=	30%	/	80%	x	4,000	/	1.0234 ^ 0.5	
		+	50%	/	80%	x	4,000	/	1.0234 ^ 1.5	
		=	1,483	+	2,415					
		=	**3,898**							
AY 2016:	unpaid	=	3,000	*(at 24 months)*						
	PV_{16}	=	50%	/	50%	x	3,000	/	1.0234 ^ 0.5	
		=	**2,966**							

==> gross PV for both AYs at: **2.34%** is **6,863**

Step 2b: calculate the gross PV for AY 2017 and AY 2016 *(gross of quota-share reinsurance)* at **1.59%**

==> gross PV for both AYs at: **1.59%** is 6,906 *(similar calculation to Step 1)*

Step 3a:	gross APV	=	6,906	+	15.00%	x	**6,863**	=	**7,936**

Step 3b:	net APV	=	6,906	x	60%		
		+	**6,863**	x	60%	x	15.00%
		+	6,863	x	40%	x	2.00%
		=	**4,816**				

Step 3c:	ceded APV	=	7,936	-	4,816	=	**3,119**

Now we can start filling in the values for the letters:

A & B are very easy: *(B is the net claims **liability** , A is the reinsurance recoverable **asset**)*

A	=	3,119	UCAE recoverable from reinsurer	(Step 3c)
B	=	7,936	gross UCAE liability	(Step 3a)

C, D & E are more confusing:

C = the GROSS "income" due to GROSS claims in 2017 *(think of it as **negative** income)*

=	(2017 gross UCAE)	-	(2016 gross UCAE)	+	(gross paid in 2017) *	
=	B	-	*given info*	+	*from paid triangle*	
=	7,936	-	4,477	+	**3,000**	
=	6,459					

(gross paid in 2017)

=	2016 @ 24	-	2016 @ 12	+	2017 @ 12
=	3,000	-	1,000	+	1,000
=	**3,000**				

D = the CEDED "income" due to CEDED claims in 2017 *(this is a **recoverable**)*

=	(2017 ceded UCAE)	-	(2016 ceded UCAE)	+	(ceded paid in 2017) **
=	A	-	*given info*	+	*see below*
=	3,119	-	1,760	+	**1,200**
=	2,559				

(ceded paid in 2017)

=	gross paid in 2017	x	40%
=	3,000	x	40%
=	**1,200**		

E = net "income" due to claims in 2017 *(this is also **negative** income)*

=	C	-	D
=	6,459	-	2,559
=	3,899		

F is easy: **if** you know that the year labels in the **left** column of the table represent **Calendar Years** **and** the year labels in the **top** row represent **Accident Years**

Use the paid loss triangle and the quota-share percentage

F	=	qs%	x	(	AY 2016 paid in CY 2017			)
	=	60%	x	(	3,000	-	1,000	)
	=	1,200						

G & H are related: H is the **excess (deficiency) ratio** and G is the **investment income** in the excess (deficiency) formula

You might like to review the practice template for the excess (defiency) ratio before proceding! In any case, we first need to calculate G. Note that UCAE + IBNR are directly from the **Runoff exhibit** in the given info.

G	=	(investment yield) *		x	avg [$(UCAE+IBNR)_{beg\ of\ 17}$, $(UCAE + IBNR)_{end\ of\ 17}$]			
	=	6.77%		x	avg [	2,717	,	2,059]
	=	162						

**** investment yield***

=	2	x	NII				
/	[$(invested\ assets)_{beg\ of\ 17}$ + $(invested\ assets)_{end\ of\ 17}$ - NII]						
=	2	x	1,800				
/	[	30,000	+	25,000	-	1,800	]
=	**6.77%**						

NII or net investment income comes from the **Income Statement**
invested assets come from the **Balance Sheet**

H	=	[$(UCAE + IBNR)_{AY16\ @\ 12}$ - $(UCAE + IBNR)_{AY16\ @\ 24}$ - $(net\ Pd)_{12\text{-}24}$ + G] / $(UCAE + IBNR)_{AY16\ @\ 12}$

Now:

$(UCAE + IBNR)_{AY16\ @\ 12}$	=	1,200	+	1,517	=	2,717
$(UCAE + IBNR)_{AY16\ @\ 24}$	=	900	+	1,159	=	2,059
$(net\ Pd)_{12\text{-}24}$	=	F			=	1,200

Therefore:

H = -14.0% **<== Excess (Deficiency) Ratio**

J is hard: J is **(gross UEP)$_{17}$** but we can't find that directly. We must first find **(net UEP)$_{17}$**.

Recall the standard formula for EP in terms of WP and UEP:

EP	=	WP	-	chg(UEP)

Apply this to our situation to obtain:

NEP_{17}	=	NWP_{17}	-	[$(net\ UEP)_{17}$ - $(net\ UEP)_{16}$]
15,800	=	16,000	-	[$(net\ UEP)_{17}$ - ($(gross\ UEP)_{16}$ - $(ceded\ UEP)_{16}$)]

Ok, this is getting messy so I'm going to let you do the algebra. Substitute these values above:

$(gross\ UEP)_{16}$	=	3,000	*<== from* ***Page 20.20*** *Balance Sheet*
$(ceded\ UEP)_{16}$	=	1,200	*<== from Page* ***20.10*** *Balance Sheet*

The result is:

$(net\ UEP)_{17}$	=	2,000

And finally, using the **quota-share percentage** to GROSS UP this net value, we obtain:

$(gross\ UEP)_{17}$	=	$(net\ UEP)_{17}$	/	**60%**
J	=	2,000	/	60%
J	=	3,333		

K (finally): K is $(net\ IBNR)_{17\ \&\ prior}$ and the standard formula is IBNR = (Total Liabilities) - Case

$(net\ IBNR)_{17\ \&\ prior}$	=	$(net\ APV)_{17\ \&\ prior}$	-	$(net\ Case)_{17\ \&\ prior}$

where

$(net\ APV)_{17\ \&\ prior}$	=	4,816	***<== from Step 3b***
$(net\ Case)_{17\ \&\ prior}$	=	2,100	***<== from Runoff Exhibit (2017 UCAE for 2017 & prior)***

therefore

K	=	4,816	-	2,100
	=	2,716		

Solution Summary:

A	=	3,119
B	=	7,936
C	=	6,459
D	=	2,559
E	=	3,899

F	=	1,200
G	=	162
H	=	-14.0%
J	=	3,333
K	=	2,716