

Paper: CCIR.ARinstr
 Problem: calculate (A,B,C,D,E,F,G,H,J,K) - there is no "I"
 Problem Type: 2018.Fall #16

(Alphabet City (Model 18.F Q16)) 01 a-Question

Balance Sheet	Page 20.10 Asset	2017	2016	
	recoverable from reinsurers:			
UEP		n/a	1,040	<== ceded values
UCAE		A	1,340	<== ceded values
total investments including cash		47,300	43,800	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	5,200	<== gross values
UCAE	B	6,700	<== gross values

Income Statement	Page 20.30 Statement of Income	2017	2016
	NWP		28,000	23,400
NEP		26,300	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		3,200	n/a

Runoff	CY	Page 60.41 Net Clms & Adj Exps Runoff		AY 2016	AY 2017	AY 2017 & prior
		Discounted				
2016		UCAE	end of year	2,100		
		IBNR	end of year	2,500		
2017		Paid	during year	F	n/a	n/a
		UCAE	end of year	1,400	n/a	3,700
		IBNR	end of year	1,900	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	6,000	6,600	0.7	1.2%
	AAA	HTM	14,000	15,680	8.0	2.9%
	A	HTM	7,000	8,400	2.0	7.0%

Triangle Data	GROSS paid loss (cumulative)			GROSS unpaid loss (undiscounted)		
	AY	12	24	AY	12	24
2016		1,500	4,400	2016	n/a	5,000
2017		1,700		2017	6,800	

Payment Pattern (incremental)	year 1	20%	MfADs	MfAD (claims):	6.00%
	year 2	30%		MfAD (re):	6.00%
	year 3	50%		MfAD (inv):	1.50%

* reinsurance quota-share RETENTION ==> 80%

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

weight *	yield	
3,960	1.2%	
112,000	2.9%	
14,000	7.0%	
	3.29%	<== 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 **3.29%**

AY 2017:	unpaid	=	6,800	(at 12 months)					
	PV ₁₇	=	30%	/	80%	x	6,800	/	1.0329 ^ 0.5
		+	50%	/	80%	x	6,800	/	1.0329 ^ 1.5
		=	2,509	+	4,049				
		=	6,558						
AY 2016:	unpaid	=	5,000	(at 24 months)					
	PV ₁₆	=	50%	/	50%	x	5,000	/	1.0329 ^ 0.5
		=	4,920						
==>		gross PV for both AYs at:	3.29%	is	11,477				

Step 2b: calculate the gross PV for AY 2017 and AY 2016 (gross of quota-share reinsurance) at **1.79%**

==> gross PV for both AYs at: **1.79%** is **11,622** (similar calculation to Step 1)

Step 3a: gross APV = **11,622** + 6.00% x **11,477** = **12,310**

Step 3b: net APV = **11,622** x 80% + **11,477** x 80% x 6.00% + **11,477** x 20% x 6.00% = **9,986**

Step 3c: ceded APV = 12,310 - 9,986 = **2,324**

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	=	<input type="text" value="2,324"/>	UCAE recoverable from reinsurer	(Step 3c)
B	=	<input type="text" value="12,310"/>	gross UCAE liability	(Step 3a)

C, D & E are more confusing:

C	=	the GROSS "income" due to GROSS claims in 2017 (<i>think of it as negative income</i>)				
	=	(2017 gross UCAE)	-	(2016 gross UCAE)	+	(gross paid in 2017) *
	=	B	-	given info	+	from paid triangle
	=	12,310	-	6,700	+	4,600
	=	<input type="text" value="10,210"/>				

* (gross paid in 2017)				
=	2016 @ 24	-	2016 @ 12	+ 2017 @ 12
=	4,400	-	1,500	+ 1,700
=	4,600			

D	=	the CEDED "income" due to CEDED claims in 2017 (<i>this is a recoverable</i>)				
	=	(2017 ceded UCAE)	-	(2016 ceded UCAE)	+	(ceded paid in 2017) **
	=	A	-	given info	+	see below
	=	2,324	-	1,340	+	920
	=	<input type="text" value="1,904"/>				

* (ceded paid in 2017)			
=	gross paid in 2017	x	20%
=	4,600	x	20%
=	920		

E	=	net "income" due to claims in 2017 (<i>this is also negative income</i>)		
	=	C	-	D
	=	10,210	-	1,904
	=	<input type="text" value="8,306"/>		

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)
	=	80%	x	(	4,400 - 1,500)
	=	2,320				

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 (deficiency) ratio before proceeding! 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}]
	=	7.28%	x	avg [4,600 , 3,300]
	=	288		

* investment yield					
	=	2	x	NII	
		/	[	(invested assets) _{beg of 17} + (invested assets) _{end of 17} - NII]
	=	2	x	3,200	
		/	[	47,300 + 43,800 - 3,200]
	=	7.28%			
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) ₁₂₋₂₄ + G] / (UCAE + IBNR) _{AY16 @ 12}
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Now:

(UCAE + IBNR) _{AY16 @ 12}	=	2,100	+	2,500	=	4,600
(UCAE + IBNR) _{AY16 @ 24}	=	1,400	+	1,900	=	3,300
(net Pd) ₁₂₋₂₄	=	F			=	2,320

Therefore:

H	=	-15.9%	<== Excess (Deficiency) Ratio
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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:

$$\text{EP} = \text{WP} - \text{chg(UEP)}$$

Apply this to our situation to obtain:

$$\begin{aligned} \text{NEP}_{17} &= \text{NWP}_{17} - [(\text{net UEP})_{17} - (\text{net UEP})_{16}] \\ 26,300 &= 28,000 - [(\text{net UEP})_{17} - ((\text{gross UEP})_{16} - (\text{ceded UEP})_{16})] \end{aligned}$$

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

$$\begin{aligned} (\text{gross UEP})_{16} &= 5,200 &<== \text{from Page 20.20 Balance Sheet} \\ (\text{ceded UEP})_{16} &= 1,040 &<== \text{from Page 20.10 Balance Sheet} \end{aligned}$$

The result is:

$$(\text{net UEP})_{17} = 5,860$$

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

$$\begin{aligned} (\text{gross UEP})_{17} &= (\text{net UEP})_{17} / 80\% \\ J &= 5,860 / 80\% \\ J &= \boxed{7,325} \end{aligned}$$

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

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

where

$$\begin{aligned} (\text{net APV})_{17 \& \text{ prior}} &= 9,986 &<== \text{from Step 3b} \\ (\text{net Case})_{17 \& \text{ prior}} &= 3,700 &<== \text{from Runoff Exhibit (2017 UCAE for 2017 & prior)} \end{aligned}$$

therefore

$$\begin{aligned} K &= 9,986 - 3,700 \\ &= \boxed{6,286} \end{aligned}$$

Solution Summary:

A	=	2,324
B	=	12,310
C	=	10,210
D	=	1,904
E	=	8,306

F	=	2,320
G	=	288
H	=	-15.9%
J	=	7,325
K	=	6,286

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(Alphabet City (Model 18.F Q16)) 02 a-Question

Balance Sheet

Page 20.10 Asset	2017	2016
recoverable from reinsurers:		
UEP	n/a	1,760
UCAE	A	2,520
total investments including cash	104,900	76,400

<== ceded values

<== ceded values

Page 20.20 Liabilities & Equity	2017	2016
UEP	J	8,800
UCAE	B	12,600

<== gross values

<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	47,000	43,600
NEP	42,700	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	4,400	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	3,800		
	IBNR end of year	3,900		
2017	Paid during year	F	n/a	n/a
	UCAE end of year	2,800	n/a	5,300
	IBNR end of year	3,300	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	6,000	5,220	1.2	1.3%
AAA	HTM	6,000	6,780	15.0	2.5%
A	HTM	8,000	9,120	4.0	6.7%

Triangle Data

GROSS paid loss (cumulative)			GROSS unpaid loss (undiscounted)		
AY	12	24	AY	12	24
2016	3,400	8,800	2016	n/a	10,500
2017	2,700		2017	12,300	

Payment Pattern (incremental)

year 1	30%
year 2	10%
year 3	60%

MfADs

MfAD (claims):	4.00%
MfAD (re):	10.00%
MfAD (inv):	1.50%

* reinsurance quota-share RETENTION ==>

80%

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

weight *	yield	
7,440	1.3%	
90,000	2.5%	
32,000	6.7%	
	3.47%	<== 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 **3.47%**

AY 2017:	unpaid	=	12,300	(at 12 months)					
	PV ₁₇	=	10%	/	70%	x	12,300	/	1.0347 ^ 0.5
		+	60%	/	70%	x	12,300	/	1.0347 ^ 1.5
		=	1,727	+	10,017				
		=	11,744						
AY 2016:	unpaid	=	10,500	(at 24 months)					
	PV ₁₆	=	60%	/	60%	x	10,500	/	1.0347 ^ 0.5
		=	10,322						
==>		gross PV for both AYs at:	3.47%	is	22,067				

Step 2b: calculate the gross PV for AY 2017 and AY 2016 (gross of quota-share reinsurance) at **1.97%**

==> gross PV for both AYs at: **1.97%** is **22,377** (similar calculation to Step 1)

Step 3a: gross APV = **22,377** + 4.00% x **22,067** = **23,260**

Step 3b: net APV = **22,377** x 80% + **22,067** x 80% x 4.00% + **22,067** x 20% x 10.00% = **19,049**

Step 3c: ceded APV = 23,260 - 19,049 = **4,211**

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	=	<input type="text" value="4,211"/>	UCAE recoverable from reinsurer	(Step 3c)
B	=	<input type="text" value="23,260"/>	gross UCAE liability	(Step 3a)

C, D & E are more confusing:

C	=	the GROSS "income" due to GROSS claims in 2017 (<i>think of it as negative income</i>)				
	=	(2017 gross UCAE)	-	(2016 gross UCAE)	+	(gross paid in 2017) *
	=	B	-	given info	+	from paid triangle
	=	23,260	-	12,600	+	8,100
	=	<input type="text" value="18,760"/>				

* (gross paid in 2017)				
=	2016 @ 24	-	2016 @ 12	+ 2017 @ 12
=	8,800	-	3,400	+ 2,700
=	8,100			

D	=	the CEDED "income" due to CEDED claims in 2017 (<i>this is a recoverable</i>)				
	=	(2017 ceded UCAE)	-	(2016 ceded UCAE)	+	(ceded paid in 2017) **
	=	A	-	given info	+	see below
	=	4,211	-	2,520	+	1,620
	=	<input type="text" value="3,311"/>				

* (ceded paid in 2017)		
=	gross paid in 2017	x 20%
=	8,100	x 20%
=	1,620	

E	=	net "income" due to claims in 2017 (<i>this is also negative income</i>)		
	=	C	-	D
	=	18,760	-	3,311
	=	<input type="text" value="15,449"/>		

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)
	=	80%	x	(	8,800 - 3,400)
	=	4,320				

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 (deficiency) ratio before proceeding! 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}]
	=	4.97%	x	avg [7,700 , 6,100]
	=	343		

* investment yield					
	=	2	x	NII	
		/ [(invested assets) _{beg of 17} + (invested assets) _{end of 17} - NII]			
	=	2	x	4,400	
		/ [104,900 + 76,400 - 4,400]			
	=	4.97%			
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) ₁₂₋₂₄ + G] / (UCAE + IBNR) _{AY16 @ 12}
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Now:

(UCAE + IBNR) _{AY16 @ 12}	=	3,800	+	3,900	=	7,700
(UCAE + IBNR) _{AY16 @ 24}	=	2,800	+	3,300	=	6,100
(net Pd) ₁₂₋₂₄	=	F			=	4,320

Therefore:

H	=	-30.9%	<== Excess (Deficiency) Ratio
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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:

$$\text{EP} = \text{WP} - \text{chg(UEP)}$$

Apply this to our situation to obtain:

$$\begin{aligned} \text{NEP}_{17} &= \text{NWP}_{17} - [(\text{net UEP})_{17} - (\text{net UEP})_{16}] \\ 42,700 &= 47,000 - [(\text{net UEP})_{17} - ((\text{gross UEP})_{16} - (\text{ceded UEP})_{16})] \end{aligned}$$

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

$$\begin{aligned} (\text{gross UEP})_{16} &= 8,800 &<== \text{from Page 20.20 Balance Sheet} \\ (\text{ceded UEP})_{16} &= 1,760 &<== \text{from Page 20.10 Balance Sheet} \end{aligned}$$

The result is:

$$(\text{net UEP})_{17} = 11,340$$

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

$$\begin{aligned} (\text{gross UEP})_{17} &= (\text{net UEP})_{17} / 80\% \\ J &= 11,340 / 80\% \\ J &= 14,175 \end{aligned}$$

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

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

where

$$\begin{aligned} (\text{net APV})_{17 \& \text{ prior}} &= 19,049 &<== \text{from Step 3b} \\ (\text{net Case})_{17 \& \text{ prior}} &= 5,300 &<== \text{from Runoff Exhibit (2017 UCAE for 2017 & prior)} \end{aligned}$$

therefore

$$\begin{aligned} K &= 19,049 - 5,300 \\ &= 13,749 \end{aligned}$$

Solution Summary:

A	=	4,211
B	=	23,260
C	=	18,760
D	=	3,311
E	=	15,449

F	=	4,320
G	=	343
H	=	-30.9%
J	=	14,175
K	=	13,749

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Problem: calculate (A,B,C,D,E,F,G,H,J,K) - there is no "I"
Problem Type: 2018.Fall #16

(Alphabet City (Model 18.F Q16)) 03 a-Question

Balance Sheet	Page 20.10 Asset	2017	2016	
	recoverable from reinsurers:			
UEP		n/a	1,440	<== ceded values
UCAE		A	2,880	<== ceded values
total investments including cash		66,300	56,700	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	4,800	<== gross values
UCAE	B	9,600	<== gross values

Income Statement	Page 20.30 Statement of Income	2017	2016
	NWP		31,000	28,500
NEP		27,600	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		3,500	n/a

Runoff	CY	Page 60.41 Net Clms & Adj Exps Runoff		AY 2016	AY 2017	AY 2017 & prior
		Discounted				
2016		UCAE	end of year	2,500		
		IBNR	end of year	2,900		
2017		Paid	during year	F	n/a	n/a
		UCAE	end of year	1,600	n/a	3,800
		IBNR	end of year	2,100	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	2,300	1.9	1.1%
	AAA	HTM	12,000	11,160	8.0	3.3%
	A	HTM	13,000	14,950	1.0	6.0%

Triangle Data	GROSS paid loss (cumulative)			GROSS unpaid loss (undiscounted)		
	AY	12	24	AY	12	24
2016		2,200	5,700	2016	n/a	5,000
2017		2,300		2017	7,000	

Payment Pattern (incremental)	year 1	20%	MfADs	MfAD (claims):	8.00%
	year 2	30%		MfAD (re):	3.00%
	year 3	50%		MfAD (inv):	2.00%

* reinsurance quota-share RETENTION ==> 70%

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

weight *	yield	
3,760	1.1%	
96,000	3.3%	
13,000	6.0%	
		3.54% <== 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 **3.54%**

AY 2017:	unpaid	=	7,000	(at 12 months)					
	PV ₁₇	=	30%	/	80%	x	7,000	/	1.0354 ^ 0.5
		+	50%	/	80%	x	7,000	/	1.0354 ^ 1.5
		=	2,580	+	4,153				
		=	6,732						
AY 2016:	unpaid	=	5,000	(at 24 months)					
	PV ₁₆	=	50%	/	50%	x	5,000	/	1.0354 ^ 0.5
		=	4,914						
=>		gross PV for both AYs at:	3.54%	is	11,646				

Step 2b: calculate the gross PV for AY 2017 and AY 2016 (gross of quota-share reinsurance) at **1.54%**

==> gross PV for both AYs at: **1.54%** is **11,843** (similar calculation to Step 1)

Step 3a: gross APV = **11,843** + 8.00% x **11,646** = **12,774**

Step 3b: net APV = **11,843** x 70% + **11,646** x 70% x 8.00% + **11,646** x 30% x 3.00% = **9,047**

Step 3c: ceded APV = 12,774 - 9,047 = **3,728**

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	=	<input type="text" value="3,728"/>	UCAE recoverable from reinsurer	(Step 3c)
B	=	<input type="text" value="12,774"/>	gross UCAE liability	(Step 3a)

C, D & E are more confusing:

C	=	the GROSS "income" due to GROSS claims in 2017 (<i>think of it as negative income</i>)				
	=	(2017 gross UCAE)	-	(2016 gross UCAE)	+	(gross paid in 2017) *
	=	B	-	given info	+	from paid triangle
	=	12,774	-	9,600	+	5,800
	=	<input type="text" value="8,974"/>				

* (gross paid in 2017)				
=	2016 @ 24	-	2016 @ 12	+ 2017 @ 12
=	5,700	-	2,200	+ 2,300
=	5,800			

D	=	the CEDED "income" due to CEDED claims in 2017 (<i>this is a recoverable</i>)				
	=	(2017 ceded UCAE)	-	(2016 ceded UCAE)	+	(ceded paid in 2017) **
	=	A	-	given info	+	see below
	=	3,728	-	2,880	+	1,740
	=	<input type="text" value="2,588"/>				

* (ceded paid in 2017)		
=	gross paid in 2017	x 30%
=	5,800	x 30%
=	1,740	

E	=	net "income" due to claims in 2017 (<i>this is also negative income</i>)		
	=	C	-	D
	=	8,974	-	2,588
	=	<input type="text" value="6,387"/>		

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)
	=	70%	x	(	5,700 - 2,200)
	=	2,450				

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 (deficiency) ratio before proceeding! 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}]
	=	5.86%	x	avg [5,400 , 3,700]
	=	267		

* investment yield					
	=	2	x	NII	
		/ [(invested assets) _{beg of 17} + (invested assets) _{end of 17} - NII]			
	=	2	x	3,500	
		/ [66,300 + 56,700 - 3,500]			
	=	5.86%			
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) ₁₂₋₂₄ + G] / (UCAE + IBNR) _{AY16 @ 12}
---	---	--

Now:

(UCAE + IBNR) _{AY16 @ 12}	=	2,500	+	2,900	=	5,400
(UCAE + IBNR) _{AY16 @ 24}	=	1,600	+	2,100	=	3,700
(net Pd) ₁₂₋₂₄	=	F			=	2,450

Therefore:

H	=	-9.0%	<== 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:

$$\text{EP} = \text{WP} - \text{chg(UEP)}$$

Apply this to our situation to obtain:

$$\begin{aligned} \text{NEP}_{17} &= \text{NWP}_{17} - [(\text{net UEP})_{17} - (\text{net UEP})_{16}] \\ 27,600 &= 31,000 - [(\text{net UEP})_{17} - ((\text{gross UEP})_{16} - (\text{ceded UEP})_{16})] \end{aligned}$$

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

$$\begin{aligned} (\text{gross UEP})_{16} &= 4,800 &<== \text{from Page 20.20 Balance Sheet} \\ (\text{ceded UEP})_{16} &= 1,440 &<== \text{from Page 20.10 Balance Sheet} \end{aligned}$$

The result is:

$$(\text{net UEP})_{17} = 6,760$$

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

$$\begin{aligned} (\text{gross UEP})_{17} &= (\text{net UEP})_{17} / 70\% \\ J &= 6,760 / 70\% \\ J &= \boxed{9,657} \end{aligned}$$

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

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

where

$$\begin{aligned} (\text{net APV})_{17 \& \text{ prior}} &= 9,047 &<== \text{from Step 3b} \\ (\text{net Case})_{17 \& \text{ prior}} &= 3,800 &<== \text{from Runoff Exhibit (2017 UCAE for 2017 & prior)} \end{aligned}$$

therefore

$$\begin{aligned} K &= 9,047 - 3,800 \\ &= \boxed{5,247} \end{aligned}$$

Solution Summary:

A	=	3,728
B	=	12,774
C	=	8,974
D	=	2,588
E	=	6,387

F	=	2,450
G	=	267
H	=	-9.0%
J	=	9,657
K	=	5,247

Paper: CCIR.ARinstr
Problem: calculate (A,B,C,D,E,F,G,H,J,K) - there is no "I"
Problem Type: 2018.Fall #16

(Alphabet City (Model 18.F Q16)) 04 a-Question

Balance Sheet

Page 20.10 Asset	2017	2016
recoverable from reinsurers:		
UEP	n/a	1,600
UCAE	A	2,480
total investments including cash	42,700	30,500

<== ceded values

<== ceded values

Page 20.20 Liabilities & Equity	2017	2016
UEP	J	4,000
UCAE	B	6,200

<== gross values

<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	23,000	25,700
NEP	23,200	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	2,200	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	1,900		
	IBNR end of year	1,900		
2017	Paid during year	F	n/a	n/a
	UCAE end of year	1,200	n/a	2,600
	IBNR end of year	1,900	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	6,000	5,520	1.8	1.3%
AAA	HTM	1,000	870	13.0	3.6%
A	HTM	13,000	14,040	1.0	6.5%

Triangle Data

GROSS paid loss (cumulative)			GROSS unpaid loss (undiscounted)		
AY	12	24	AY	12	24
2016	1,600	4,200	2016	n/a	5,100
2017	1,700		2017	5,100	

Payment Pattern (incremental)

year 1	10%
year 2	20%
year 3	70%

MfADs

MfAD (claims):	13.00%
MfAD (re):	4.00%
MfAD (inv):	0.50%

* reinsurance quota-share RETENTION ==>

60%

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

weight *	yield	
10,620	1.3%	
13,000	3.6%	
13,000	6.5%	
	3.96%	<== 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 **3.96%**

AY 2017:	unpaid	=	5,100	(at 12 months)					
	PV ₁₇	=	20%	/	90%	x	5,100	/	1.0396 ^ 0.5
		+	70%	/	90%	x	5,100	/	1.0396 ^ 1.5
		=	1,112	+	3,742				
		=	4,854						
AY 2016:	unpaid	=	5,100	(at 24 months)					
	PV ₁₆	=	70%	/	70%	x	5,100	/	1.0396 ^ 0.5
		=	5,002						
==>		gross PV for both AYs at:	3.96%	is	9,856				

Step 2b: calculate the gross PV for AY 2017 and AY 2016 (gross of quota-share reinsurance) at **3.46%**

==> gross PV for both AYs at: **3.46%** is **9,898** (similar calculation to Step 1)

Step 3a: gross APV = 9,898 + 13.00% x 9,856 = **11,179**

Step 3b: net APV = 9,898 x 60% + 9,856 x 60% x 13.00% + 9,856 x 40% x 4.00% = **6,865**

Step 3c: ceded APV = 11,179 - 6,865 = **4,314**

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	=	<input type="text" value="4,314"/>	UCAE recoverable from reinsurer	(Step 3c)
B	=	<input type="text" value="11,179"/>	gross UCAE liability	(Step 3a)

C, D & E are more confusing:

C	=	the GROSS "income" due to GROSS claims in 2017 (<i>think of it as negative income</i>)				
	=	(2017 gross UCAE)	-	(2016 gross UCAE)	+	(gross paid in 2017) *
	=	B	-	given info	+	from paid triangle
	=	11,179	-	6,200	+	4,300
	=	<input type="text" value="9,279"/>				

* (gross paid in 2017)					
=	2016 @ 24	-	2016 @ 12	+	2017 @ 12
=	4,200	-	1,600	+	1,700
=	4,300				

D	=	the CEDED "income" due to CEDED claims in 2017 (<i>this is a recoverable</i>)				
	=	(2017 ceded UCAE)	-	(2016 ceded UCAE)	+	(ceded paid in 2017) **
	=	A	-	given info	+	see below
	=	4,314	-	2,480	+	1,720
	=	<input type="text" value="3,554"/>				

* (ceded paid in 2017)			
=	gross paid in 2017	x	40%
=	4,300	x	40%
=	1,720		

E	=	net "income" due to claims in 2017 (<i>this is also negative income</i>)		
	=	C	-	D
	=	9,279	-	3,554
	=	<input type="text" value="5,725"/>		

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	(	4,200 - 1,600)
	=	1,560				

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 (deficiency) ratio before proceeding! 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}]
	=	6.20%	x	avg [3,800 , 3,100]
	=	214		

* investment yield				
	=	2	x	NII
		/	[	(invested assets) _{beg of 17} + (invested assets) _{end of 17} - NII]
	=	2	x	2,200
		/	[	42,700 + 30,500 - 2,200]
	=	6.20%		
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) ₁₂₋₂₄ + G] / (UCAE + IBNR) _{AY16 @ 12}
---	---	--

Now:

(UCAE + IBNR) _{AY16 @ 12}	=	1,900	+	1,900	=	3,800
(UCAE + IBNR) _{AY16 @ 24}	=	1,200	+	1,900	=	3,100
(net Pd) ₁₂₋₂₄	=	F			=	1,560

Therefore:

H	=	-17.0%	<== Excess (Deficiency) Ratio
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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:

$$\text{EP} = \text{WP} - \text{chg(UEP)}$$

Apply this to our situation to obtain:

$$\begin{aligned} \text{NEP}_{17} &= \text{NWP}_{17} - [(\text{net UEP})_{17} - (\text{net UEP})_{16}] \\ 23,200 &= 23,000 - [(\text{net UEP})_{17} - ((\text{gross UEP})_{16} - (\text{ceded UEP})_{16})] \end{aligned}$$

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

$$\begin{aligned} (\text{gross UEP})_{16} &= 4,000 &<== \text{from Page 20.20 Balance Sheet} \\ (\text{ceded UEP})_{16} &= 1,600 &<== \text{from Page 20.10 Balance Sheet} \end{aligned}$$

The result is:

$$(\text{net UEP})_{17} = 2,200$$

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

$$\begin{aligned} (\text{gross UEP})_{17} &= (\text{net UEP})_{17} / 60\% \\ J &= 2,200 / 60\% \\ J &= \boxed{3,667} \end{aligned}$$

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

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

where

$$\begin{aligned} (\text{net APV})_{17 \& \text{ prior}} &= 6,865 &<== \text{from Step 3b} \\ (\text{net Case})_{17 \& \text{ prior}} &= 2,600 &<== \text{from Runoff Exhibit (2017 UCAE for 2017 & prior)} \end{aligned}$$

therefore

$$\begin{aligned} K &= 6,865 - 2,600 \\ &= \boxed{4,265} \end{aligned}$$

Solution Summary:

A	=	4,314
B	=	11,179
C	=	9,279
D	=	3,554
E	=	5,725

F	=	1,560
G	=	214
H	=	-17.0%
J	=	3,667
K	=	4,265