Paper: CCIR.ARinstr (Alphabet City (Model 18.F Q16)) 05 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	2,100	<== ceded values
UCAE	A	3,600	<== ceded values
total investments including cash	46,100	29,100	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	3,500	<== gross values
UCAE	B	6,000	<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	23,000	18,100
NEP	20,200	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	2,700	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	2,100		
2017	Paid	*during year*	F	n/a	n/a
	UCAE	end of year	1,100	n/a	3,000
	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	8,000	8,320	0.7	1.3%
AAA	HTM	15,000	12,300	11.0	2.4%
A	HTM	11,000	9,900	2.0	5.3%

Triangle Data

GROSS paid loss (cumulative)

AY	12	24
2016	1,600	5,100
2017	1,600	

GROSS unpaid loss (undiscounted)

AY	12	24
2016	n/a	4,100
2017	6,300	

Payment Pattern *(incremental)*

year 1	20%
year 2	20%
year 3	60%

MfADs

MfAD (claims):	16.00%
MfAD (re):	2.00%
MfAD (inv):	1.00%

* reinsurance quota-share RETENTION ==> **40%**

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

weight *	yield	
5,920	1.3%	
165,000	2.4%	
22,000	5.3%	
	2.70%	<== 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 **2.70%**

AY 2017: unpaid = 6,300 *(at 12 months)*

PV_{17} = 20% / 80% x 6,300 / 1.027 ^ 0.5
\+ 60% / 80% x 6,300 / 1.027 ^ 1.5
= 1,554 + 4,540
= **6,094**

AY 2016: unpaid = 4,100 *(at 24 months)*

PV_{16} = 60% / 60% x 4,100 / 1.027 ^ 0.5
= **4,046**

==> gross PV for both AYs at: **2.70%** is **10,140**

Step 2b: calculate the gross PV for AY 2017 and AY 2016 *(gross of quota-share reinsurance)* at **1.70%**

==> gross PV for both AYs at: **1.70%** is 10,234 *(similar calculation to Step 1)*

Step 3a: gross APV = 10,234 + 16.00% x **10,140** = **11,857**

Step 3b: net APV
= 10,234 x 40%
\+ **10,140** x 40% x 16.00%
\+ 10,140 x 60% x 2.00%
= **4,864**

Step 3c: ceded APV = 11,857 - 4,864 = **6,992**

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	=	6,992	UCAE recoverable from reinsurer	(Step 3c)
B	=	11,857	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*	
=	11,857	-	6,000	+	**5,100**	
=	10,957					

(gross paid in 2017)

=	2016 @ 24	-	2016 @ 12	+	2017 @ 12
=	5,100	-	1,600	+	1,600
=	**5,100**				

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*
=	6,992	-	3,600	+	**3,060**
=	6,452				

(ceded paid in 2017)

=	gross paid in 2017	x	60%
=	5,100	x	60%
=	**3,060**		

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

=	C	-	D
=	10,957	-	6,452
=	4,504		

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			)
	=	40%	x	(	5,100	-	1,600	)
	=	1,400						

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 [$(UCAE+IBNR)_{beg\ of\ 17}$, $(UCAE + IBNR)_{end\ of\ 17}$]			
	=	7.45%		x	avg [	4,000	,	3,000]
	=	261						

**** investment yield***

	=	2	x	NII				
	/	[(invested assets)$_{beg\ of\ 17}$ + (invested assets)$_{end\ of\ 17}$ - NII]						
	=	2	x	2,700				
	/	[	46,100	+	29,100	-	2,700	]
	=	**7.45%**						

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:

$(UCAE + IBNR)_{AY16\ @\ 12}$	=	1,900	+	2,100	=	4,000
$(UCAE + IBNR)_{AY16\ @\ 24}$	=	1,100	+	1,900	=	3,000
$(net\ Pd)_{12\text{-}24}$	=	F			=	1,400

Therefore:

H = -3.5% **<== 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}	-	[$(net\ UEP)_{17}$ - $(net\ UEP)_{16}$]
20,200	=	23,000	-	[$(net\ UEP)_{17}$ - ($(gross\ UEP)_{16}$ - $(ceded\ UEP)_{16}$)]

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

$(gross\ UEP)_{16}$	=	3,500	*<== from* ***Page 20.20*** *Balance Sheet*
$(ceded\ UEP)_{16}$	=	2,100	*<== from Page* ***20.10*** *Balance Sheet*

The result is:

$(net\ UEP)_{17}$	=	4,200

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

$(gross\ UEP)_{17}$	=	$(net\ UEP)_{17}$	/	**40%**
J	=	4,200	/	40%
J	=	10,500		

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

$(net\ APV)_{17\ \&\ prior}$	=	4,864	***<== from Step 3b***
$(net\ Case)_{17\ \&\ prior}$	=	3,000	***<== from Runoff Exhibit (2017 UCAE for 2017 & prior)***

therefore

K	=	4,864	-	3,000
	=	1,864		

Solution Summary:

A	=	6,992
B	=	11,857
C	=	10,957
D	=	6,452
E	=	4,504

F	=	1,400
G	=	261
H	=	-3.5%
J	=	10,500
K	=	1,864

Paper: CCIR.ARinstr (Alphabet City (Model 18.F Q16)) 06 a-Question
Problem: calculate (A,B,C,D,E,F,G,H,J,K) - there is no "I"
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Balance Sheet

Page 20.10 Asset	2017	2016	
recoverable from reinsurers:			
UEP	n/a	2,200	<== ceded values
UCAE	A	2,650	<== ceded values
total investments including cash	38,400	40,900	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	4,400	<== gross values
UCAE	B	5,300	<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	22,000	20,800
NEP	20,900	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	2,600	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	1,700		
	IBNR	end of year	1,800		
2017	Paid	*during year*	F	n/a	n/a
	UCAE	end of year	1,200	n/a	2,400
	IBNR	end of year	1,300	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	12,000	9,600	1.6	1.4%
AAA	HTM	12,000	12,720	10.0	2.0%
A	HTM	10,000	9,100	2.0	5.0%

Triangle Data

GROSS paid loss (cumulative)

AY	12	24
2016	1,700	3,300
2017	1,200	

GROSS unpaid loss (undiscounted)

AY	12	24
2016	n/a	4,400
2017	6,100	

Payment Pattern *(incremental)*

year 1	30%
year 2	30%
year 3	40%

MfADs

MfAD (claims):	20.00%
MfAD (re):	14.00%
MfAD (inv):	1.50%

* reinsurance quota-share RETENTION ==> **50%**

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

weight *	yield	
18,720	1.4%	
120,000	2.0%	
20,000	5.0%	
	2.31%	<== 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 **2.31%**

AY 2017: unpaid = 6,100 *(at 12 months)*

PV_{17}	=	30%	/	70%	x	6,100	/	1.0231 ^ 0.5
	+	40%	/	70%	x	6,100	/	1.0231 ^ 1.5
	=	2,585	+	3,368				
	=	**5,953**						

AY 2016: unpaid = 4,400 *(at 24 months)*

PV_{16}	=	40%	/	40%	x	4,400	/	1.0231 ^ 0.5
	=	**4,350**						

==> gross PV for both AYs at: **2.31%** is **10,303**

Step 2b: calculate the gross PV for AY 2017 and AY 2016 *(gross of quota-share reinsurance)* at **0.81%**

==> gross PV for both AYs at: **0.81%** is 10,430 *(similar calculation to Step 1)*

Step 3a:	gross APV	=	10,430	+	20.00%	x	**10,303**	=	**12,490**

Step 3b:	net APV	=	10,430	x	50%		
		+	**10,303**	x	50%	x	20.00%
		+	10,303	x	50%	x	14.00%
		=	**6,966**				

Step 3c:	ceded APV	=	12,490	-	6,966	=	**5,524**

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	=	5,524	UCAE recoverable from reinsurer	(Step 3c)
B	=	12,490	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*	
=	12,490	-	5,300	+	**2,800**	
=	9,990					

(gross paid in 2017)

=	2016 @ 24	-	2016 @ 12	+	2017 @ 12
=	3,300	-	1,700	+	1,200
=	**2,800**				

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*
=	5,524	-	2,650	+	**1,400**
=	4,274				

(ceded paid in 2017)

=	gross paid in 2017	x	50%
=	2,800	x	50%
=	**1,400**		

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

=	C	-	D
=	9,990	-	4,274
=	5,716		

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			)
	=	50%	x	(	3,300	-	1,700	)
	=	800						

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 [$(UCAE+IBNR)_{beg\ of\ 17}$, $(UCAE + IBNR)_{end\ of\ 17}$]			
	=	6.78%		x	avg [	3,500	,	2,500]
	=	203						

**** investment yield***

	=	2	x	NII				
	/	[(invested assets)$_{beg\ of\ 17}$ + (invested assets)$_{end\ of\ 17}$ - NII]						
	=	2	x	2,600				
	/	[	38,400	+	40,900	-	2,600	]
	=	**6.78%**						

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:

$(UCAE + IBNR)_{AY16\ @\ 12}$	=	1,700	+	1,800	=	3,500
$(UCAE + IBNR)_{AY16\ @\ 24}$	=	1,200	+	1,300	=	2,500
$(net\ Pd)_{12\text{-}24}$	=	F			=	800

Therefore:

H = 11.5% **<== 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}	-	[$(net\ UEP)_{17}$ - $(net\ UEP)_{16}$]
20,900	=	22,000	-	[$(net\ UEP)_{17}$ - ($(gross\ UEP)_{16}$ - $(ceded\ UEP)_{16}$)]

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

$(gross\ UEP)_{16}$	=	4,400	*<== from* ***Page 20.20*** *Balance Sheet*
$(ceded\ UEP)_{16}$	=	2,200	*<== from Page* ***20.10*** *Balance Sheet*

The result is:

$(net\ UEP)_{17}$	=	3,300

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

$(gross\ UEP)_{17}$	=	$(net\ UEP)_{17}$	/	**50%**
J	=	3,300	/	50%
J	=	6,600		

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

$(net\ APV)_{17\ \&\ prior}$	=	6,966	***<== from Step 3b***
$(net\ Case)_{17\ \&\ prior}$	=	2,400	***<== from Runoff Exhibit (2017 UCAE for 2017 & prior)***

therefore

K	=	6,966	-	2,400
	=	4,566		

Solution Summary:

A	=	5,524
B	=	12,490
C	=	9,990
D	=	4,274
E	=	5,716

F	=	800
G	=	203
H	=	11.5%
J	=	6,600
K	=	4,566

Paper: CCIR.ARinstr (Alphabet City (Model 18.F Q16)) 07 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	1,520	<== ceded values
UCAE	A	1,920	<== ceded values
total investments including cash	29,000	21,300	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	3,800	<== gross values
UCAE	B	4,800	<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	17,000	16,100
NEP	17,600	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	2,000	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	1,100		
	IBNR	end of year	1,800		
2017	Paid	*during year*	F	n/a	n/a
	UCAE	end of year	900	n/a	2,500
	IBNR	end of year	1,300	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	15,000	13,950	1.3	1.3%
AAA	HTM	10,000	11,600	10.0	2.2%
A	HTM	2,000	2,160	1.0	6.6%

Triangle Data

GROSS paid loss (cumulative)

AY	12	24
2016	1,300	3,100
2017	1,300	

GROSS unpaid loss (undiscounted)

AY	12	24
2016	n/a	3,800
2017	3,700	

Payment Pattern *(incremental)*

year 1	10%
year 2	10%
year 3	80%

MfADs

MfAD (claims):	15.00%
MfAD (re):	9.00%
MfAD (inv):	0.25%

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

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

weight *	yield	
18,900	1.3%	
100,000	2.2%	
2,000	6.6%	
	2.13%	<== 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 **2.13%**

AY 2017:	unpaid	=	3,700	*(at 12 months)*						
	PV_{17}	=	10%	/	90%	x	3,700	/	1.0213 ^ 0.5	
		+	80%	/	90%	x	3,700	/	1.0213 ^ 1.5	
		=	407	+	3,187					
		=	**3,593**							
AY 2016:	unpaid	=	3,800	*(at 24 months)*						
	PV_{16}	=	80%	/	80%	x	3,800	/	1.0213 ^ 0.5	
		=	**3,760**							

==> gross PV for both AYs at: **2.13%** is **7,354**

Step 2b: calculate the gross PV for AY 2017 and AY 2016 *(gross of quota-share reinsurance)* at **1.88%**

==> gross PV for both AYs at: **1.88%** is 7,370 *(similar calculation to Step 1)*

Step 3a:	gross APV	=	7,370	+	15.00%	x	**7,354**	=	**8,473**

Step 3b:	net APV	=	7,370	x	60%		
		+	**7,354**	x	60%	x	15.00%
		+	7,354	x	40%	x	9.00%
		=	**5,349**				

Step 3c:	ceded APV	=	8,473	-	5,349	=	**3,125**

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	=	3,125	UCAE recoverable from reinsurer	(Step 3c)
B	=	8,473	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*	
=	8,473	-	4,800	+	**3,100**	
=	6,773					

(gross paid in 2017)

=	2016 @ 24	-	2016 @ 12	+	2017 @ 12
=	3,100	-	1,300	+	1,300
=	**3,100**				

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*
=	3,125	-	1,920	+	**1,240**
=	2,445				

(ceded paid in 2017)

=	gross paid in 2017	x	40%
=	3,100	x	40%
=	**1,240**		

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

=	C	-	D
=	6,773	-	2,445
=	4,329		

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	(	3,100 - 1,300	)
	=	1,080				

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 [$(UCAE+IBNR)_{beg\ of\ 17}$, $(UCAE + IBNR)_{end\ of\ 17}$]
	=	8.28%	x	avg [2,900 , 2,200]
	=	211		

**** investment yield***

	=	2	x	NII			
	/	[$(invested\ assets)_{beg\ of\ 17}$ + $(invested\ assets)_{end\ of\ 17}$ - NII]					
	=	2	x	2,000			
	/	[	29,000	+	21,300	-	2,000]
	=	**8.28%**					

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] / $(UCAE + IBNR)_{AY16\ @\ 12}$

Now:

$(UCAE + IBNR)_{AY16\ @\ 12}$	=	1,100	+	1,800	=	2,900
$(UCAE + IBNR)_{AY16\ @\ 24}$	=	900	+	1,300	=	2,200
$(net\ Pd)_{12-24}$	=	F			=	1,080

Therefore:

H = -5.8% **<== 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)$_{16}$]
17,600	=	17,000	-	[(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)$_{16}$	=	3,800	*<== from **Page 20.20** Balance Sheet*
(ceded UEP)$_{16}$	=	1,520	*<== from Page **20.10** Balance Sheet*

The result is:

(net UEP)$_{17}$	=	1,680

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

(gross UEP)$_{17}$	=	(net UEP)$_{17}$	/	**60%**
J	=	1,680	/	60%
J	=	2,800		

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)$_{17\ \&\ prior}$	=	5,349	***<== from Step 3b***
(net Case)$_{17\ \&\ prior}$	=	2,500	***<== from Runoff Exhibit (2017 UCAE for 2017 & prior)***

therefore

K	=	5,349	-	2,500
	=	2,849		

Solution Summary:

A	=	3,125
B	=	8,473
C	=	6,773
D	=	2,445
E	=	4,329

F	=	1,080
G	=	211
H	=	-5.8%
J	=	2,800
K	=	2,849

Paper: CCIR.ARinstr (Alphabet City (Model 18.F Q16)) 08 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	3,710	<== ceded values
UCAE	A	4,410	<== ceded values
total investments including cash	51,800	43,100	

Page 20.20 Liabilities & Equity	2017	2016	
UEP	J	5,300	<== gross values
UCAE	B	6,300	<== gross values

Income Statement

Page 20.30 Statement of Income	2017	2016
NWP	24,000	26,800
NEP	20,600	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	2,700	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	1,700		
	IBNR	end of year	2,700		
2017	Paid	*during year*	F	n/a	n/a
	UCAE	end of year	1,100	n/a	2,800
	IBNR	end of year	1,500	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	2,000	1.7	1.3%
AAA	HTM	14,000	11,480	14.0	4.0%
A	HTM	1,000	1,160	2.0	6.6%

Triangle Data

GROSS paid loss (cumulative)

AY	12	24
2016	1,300	4,100
2017	1,500	

GROSS unpaid loss (undiscounted)

AY	12	24
2016	n/a	3,900
2017	6,500	

Payment Pattern *(incremental)*

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

MfADs

MfAD (claims):	6.00%
MfAD (re):	7.00%
MfAD (inv):	1.75%

* reinsurance quota-share RETENTION ==> **30%**

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

weight *	yield	
3,320	1.3%	
196,000	4.0%	
2,000	6.6%	
	3.98%	<== 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 **3.98%**

AY 2017:	unpaid	=	6,500	*(at 12 months)*						
	PV_{17}	=	10%	/	80%	x	6,500	/	1.0398 ^ 0.5	
		+	70%	/	80%	x	6,500	/	1.0398 ^ 1.5	
		=	797	+	5,364					
		=	**6,161**							
AY 2016:	unpaid	=	3,900	*(at 24 months)*						
	PV_{16}	=	70%	/	70%	x	3,900	/	1.0398 ^ 0.5	
		=	**3,825**							

==> gross PV for both AYs at: **3.98%** is **9,986**

Step 2b: calculate the gross PV for AY 2017 and AY 2016 *(gross of quota-share reinsurance)* at **2.23%**

==> gross PV for both AYs at: **2.23%** is 10,163 *(similar calculation to Step 1)*

Step 3a:	gross APV	=	10,163	+	6.00%	x	**9,986**	=	**10,762**
Step 3b:	net APV	=	10,163	x	30%				
		+	**9,986**	x	30%	x	6.00%		
		+	9,986	x	70%	x	7.00%		
		=	**3,718**						
Step 3c:	ceded APV	=	10,762	-	3,718	=	**7,044**		

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	=	7,044	UCAE recoverable from reinsurer	(Step 3c)
B	=	10,762	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*	
=	10,762	-	6,300	+	**4,300**	
=	8,762					

(gross paid in 2017)

=	2016 @ 24	-	2016 @ 12	+	2017 @ 12
=	4,100	-	1,300	+	1,500
=	**4,300**				

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*
=	7,044	-	4,410	+	**3,010**
=	5,644				

(ceded paid in 2017)

=	gross paid in 2017	x	70%
=	4,300	x	70%
=	**3,010**		

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

=	C	-	D
=	8,762	-	5,644
=	3,118		

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			)
	=	30%	x	(	4,100	-	1,300	)
	=	840						

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 [$(UCAE+IBNR)_{beg\ of\ 17}$, $(UCAE + IBNR)_{end\ of\ 17}$]			
	=	5.86%		x	avg [	4,400	,	2,600]
	=	205						

**** investment yield***

=	2	x	NII				
/	[$(invested\ assets)_{beg\ of\ 17}$ + $(invested\ assets)_{end\ of\ 17}$ - NII]						
=	2	x	2,700				
/	[	51,800	+	43,100	-	2,700	]
=	**5.86%**						

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

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

Now:

$(UCAE + IBNR)_{AY16\ @\ 12}$	=	1,700	+	2,700	=	4,400
$(UCAE + IBNR)_{AY16\ @\ 24}$	=	1,100	+	1,500	=	2,600
$(net\ Pd)_{12\text{-}24}$	=	F			=	840

Therefore:

H = 26.5% **<== 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)$_{16}$]
20,600	=	24,000	-	[(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)$_{16}$	=	5,300	*<== from **Page 20.20** Balance Sheet*
(ceded UEP)$_{16}$	=	3,710	*<== from Page **20.10** Balance Sheet*

The result is:

(net UEP)$_{17}$	=	4,990

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

(gross UEP)$_{17}$	=	(net UEP)$_{17}$	/	**30%**
J	=	4,990	/	30%
J	=	16,633		

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)$_{17\ \&\ prior}$	=	3,718	***<== from Step 3b***
(net Case)$_{17\ \&\ prior}$	=	2,800	***<== from Runoff Exhibit (2017 UCAE for 2017 & prior)***

therefore

K	=	3,718	-	2,800
	=	918		

Solution Summary:

A	=	7,044
B	=	10,762
C	=	8,762
D	=	5,644
E	=	3,118

F	=	840
G	=	205
H	=	26.5%
J	=	16,633
K	=	918