OVERVIEW OF MODEL SOLUTION DOCUMENT

The following solutions are presented to help candidates understand how graders evaluated candidate responses to the 6/1/2020 version of the Final Assessment, and to provide examples of passing answers.

Each section includes information about what was needed to pass, some common candidate mistakes, and representative answers.

The sections for tasks 1-3 each include two representative candidate answers that passed. This does not imply there are not other additional valid ways to construct the response; rather it is meant to be an indication that there are a variety of possible methods.

Tasks 4-6 each show one representative candidate answer that passed. Again, this does not imply there are not other additional valid ways to construct the response.

TASK 1

Requirements to pass the task

Candidates must demonstrate understanding of the usefulness of the data, data cleansing, and materiality of significant information presented. Candidates must demonstrate alignment with actuarial data quality standards. Candidate should identify at least six data anomalies. For each anomaly there must be a clear indication of reasonable/appropriate action needed to be taken. Candidates must provide sound analysis and supporting evidence for any action.

Common pitfalls:

- Simply stating ASOP 23 does not portray clear understanding of data quality issues.
- Data adjustments or corrections that indicate poor understanding of the data provided. For example, reversing the sign of the amounts from a negative to a positive number, or simply deleting data that could discard useful information otherwise given.
- Unclear or missing recommendations.
- Unclear or missing support.
- Referring all issues back to the veterinarians.

Representative Solution A:

This memo serves as documentation of our assessment of the data quality. This data contains 9 fields: VetID, DogID, Age, Gender, Breed, VetProc, Billed$, DOS, and ProcDesc. Further descriptions of these fields can be found in the Data Definitions tab of the worksheet provided with the data.

Upon review of the data, there were numerous issues found such as blank or missing values, possible typos, shortened names, and possible misunderstanding of the billing entry form. Major issues have been listed below.

1. Almost all fields contain blank or missing values which will impact any downstream analyses. To resolve this, an email communication should be sent to all participating vets urging them to complete these entries to the best of their abilities as it benefits their patients to submit complete forms.
2. DogID is blank for 33% of the entries. This may create significant issues when attempting to calculate annual and/or lifetime maximums for patients. All blank DogIDs were submitted by Vet4 and all of Vet4's DogIDs were submitted as blank. It is recommended to reach out to Vet4 to fix this issue.
3. The Age field contains values counted in both years and months (12, 24, etc.). All field issues were received from Vet3. To resolve this, Attaboy should reach out to Vet3 stating the units of the Age field is in years, not months.
4. 36% of the field Breed contains "T" which could be short for either Terrier or Toy. I am unable to infer which breed to bucket these patients into. The only resolution is to request the vet resubmit their form with the full name.
5. Breed also contains values for "Hnd." It is recommended to rename these to "Hound" and refraining from contacting the veterinarians.
6. Breed values for "Other" can be bucketed into either "NonPurebred" or "Other Purebred". 10% of entries are either blank or "Other" thus a resolution would be for Attaboy to accept "Other" as a breed submission. This would allow for long-term flexibility in plan design and pricing. A recommended interim fix is to rename "Other" to "Other Purebred."
7. 7% of VetProc is blank, all provided by Vet4 with 22% of their submissions having a missing procedure code. It is recommended to reach out to Vet4 and have them resubmit data.

8. Billed amounts submitted by Vet4 are a few orders of magnitude greater than other vets. For example, Vet4's average PMPY is $12,638.17 compared to the average PMPY for other vets of $142.54. This could be due to typos in form submission. It is of note that Vet4 also submitted billed amounts in line with other vets as well and all large billed submissions contained breed "T". To resolve this, it is suggested to remove all rows from Vet4 with breed "T".

Overall, there seems to be a thorough misunderstanding of the claim submission form. I have recommended four steps below which would lead to more accurate claims.

1. Change the claim submission form as listed below.
    a. Make VetID, DogID, Age, Breed, VetProc, and Billed$ required fields. These fields are all used by Attaboy to confirm eligibility of the patient and coverage of the claim thus without one piece of information, the claim cannot be covered.
    b. Allow for entries of "Other" in the Breed field to help reconcile the vagueness of what breed of dog is being treated.
2. Conduct a training for all vets to attend covering proper form completion and submission. Explain the benefits to all parties (carrier, provider, and patient) of submitting a complete and accurate claim. This would assist with all data issues listed above.
3. Fix values which can be fixed like "Hnd" in the breed field and dividing by 12 months for any value higher than 12 in the Age field.
4. Remove all submissions with a breed of "T" and "Other" as our firm cannot decipher where to properly bucket them.

In conclusion, I recommend that all steps above be taken to optimize Attaboy's claims and analytics process allowing Attaboy Insurance to best serve their patients and providers.

Representative Solution B:

1. Missing information

1.1. Dog ID

Dog ID is the identification number assigned by the vet for each unique dog with submitted claims. There are 54 records with a blank Dog ID, which represents about 32% of the entire sample. My recommendation is to assign identification numbers to each of these records.

These 54 records were documented by Vet 4. Since the Dog ID is blank, we cannot tell if multiple records with the same age, gender and breed belong to one dog or multiple dogs with the same characteristics. For example, looking at the 3 records below, the information could represent (a) one dog who visited the vet three times (b) one dog who visited the vet once and another dog who visited the vet twice or (c) three dogs who visited the vet once.

VetID	DogID	Age	Gender	Breed	VetProc	Billed$	DOS	ProcDesc
Vet4		7	F	T	10	40	Year3	Vet Visits
Vet4		7	F	T	10	43	Year3	Vet Visits
Vet4		7	F	T	10	73	Year3	Vet Visits

We will make a simplified assumption that the records with the same age, gender and breed belong to the same dog. Therefore, only one identification number will be assigned to the records with the same age, gender and breed for Vet 4.

This information is important because there is an annual benefit payment limit and a lifetime benefit payment limit for Attaboy Basic. Since we are assigning the Dog ID's to Vet 4's dogs, we will want to

inform Vet 4 of the identification numbers and let him know to use these numbers for the same dogs moving forward, if they decide to purchase Attaboy Basic.

The Dog ID's will not impact the data analysis, but issues could arise when the values are left blank. For example, if you want to ensure all the records are loaded into the model properly (i.e., no data are lost or corrupted), you would compare the record count from the source file to the record count in the model. If some of the Dog ID's remain blank, these records could be omitted from the record count, and it could seem like all the records were loaded properly, when in reality the 54 records were lost in the data transfer.

1.2. Procedure

There are 12 records with no information in the VetProc field, which is the vet procedure (e.g., vet visit, surgery, inpatient hospital, etc.). These records were documented by Vet 4. I recommend asking Vet 4 what type of procedures were performed [1]. I do not recommend removing these records from the sample because it is the only information we have about the Non Purebred breed.

If the vet does not respond, I would recommend removing these records from the sample and using industry data to understand the claim costs for Non Purebred breeds.

1.3. Breed

There are 13 records with no information in the Breed field, which should either be Hound, Non Purebred, Other Purebred, Terrier or Toy. 11 of these records were documented by Vet 3 and represent 2 dogs (since there are 2 unique Dog IDs). 2 of these records were documented by Vet 6 and represent 1 dog (since there is 1 unique Dog ID). I recommend asking the vets to identify the type of breeds for these 3 dogs [2], [3]. This should be a quick and simple information request.

If the vets do not respond, I think it acceptable to remove these 13 records. Out of the 11 records documented by Vet 3, 2 represent vet visits and 9 represent specialist visits. For Vet 3, there are 13 other records which represent vet visits and 27 other records which represent specialist visits, with the Breed field populated. Additionally, the 2 records documented by Vet 6 represent vet visits, and there are 16 other records which represent vet visits by Vet 6, with the Breed field populated. We should have enough information about the billed amount for vet visits and specialist visits by Vet 3 and vet visits by Vet 6 after removing these records, although I think it would be best to get clarification from the vets, since it is a simple request.

2. Unusual values

2.1. Age

Age is the age of the dogs in dog years. There are some records with Age = 60, 84 and 96, although it is a known fact that dogs cannot live this long. These ages were documented by Vet 3. The other ages documented by Vet 3 were 12 and 24. Since all these ages are multiples of 12, it is a reasonable assumption that Vet 3 documented the ages in months instead of years. My recommendation is to convert the ages from months to years.

As a reasonability check, I looked at the ages documented by Vet 4 and Vet 6. The youngest dog for these vets is 0 and the oldest is 9. After converting Vet 3's ages from months to years, the youngest dog is 1 and the oldest is 8. Since 1 and 8 are within the rage of 0 to 9, this data transformation seems reasonable.

2.2. Billed amount for Vet Visits

I noticed some unusual values for Billed$, the amount billed by vet for procedure, specifically for Vet Visits recorded by Vet 4. Some of the unusual values were negative (including -$75, -$66 and -$45) and

others were very large compared to the other records (including $44,000 and $66,000). Since the amount billed varies by vet and procedure, I decided to look at the amount billed for Vet Visits recorded by all the vets.

For vet visits by Vet 3, the minimum bill was $30, the maximum bill was $68 and the mean bill was $36. For vet visits by Vet 6, the minimum bill was $60, the maximum bill was $147 and the mean bill was $84. Excluding the unusual values for vet visits by Vet 4, the minimum bill was $40, the maximum bill was $80 and the mean bill was $61.

Based on the distribution of these values, my recommendation is to adjust the data according to the rules shown below.

Initial value of Billed$ ($)	Adjusted value of Billed$ ($)
-75	75
-66	66
-45	45
44,000	44
66,000	66

As a reasonability check, I graphed the amount billed for vet visits by vets, with the adjustments for Vet 4 (colored in yellow). Looking at the graph, I believe making the adjustments is a reasonable approach because the adjusted values are within the bounds of the billed amount for vet visits by Vet 3 and Vet 6.

2.3. Billed amount for Surgery

There are 2 records with VetProc = 50, which means the procedure performed was surgery. 1 record was documented by Vet 4 and has a billed amount equal to -$1,211. The other record was documented by Vet 6 and has a billed amount equal to $3,380. Since a negative billed amount does not make sense, I would recommend changing the billed amount to a positive value of $1,211. This value seems reasonable compared to the other surgery, and I believe it is acceptable to assume the negative sign was accidently recorded by Vet 4.

3. Inconsistencies

3.1. Breed – Hound

There are 2 records with Breed = Hnd. I recommend changing this value to Hound. It is reasonable to assume Hnd and Hound are synonymous, and we would like the names to be consistent.

3.2. Breed – Other

There are 3 records with Breed = Other. I recommend changing this value to Other Purebred. It is reasonable to assume Other and Other Purebred are synonymous, since the other available options for breed were Hound, Non Purebred, Terrier and Toy. With this change, the names will be consistent.

3.3. Breed – Terrier vs Toy

There are 62 records with Breed = T. 6 of these records were documented by Vet 3, 22 of these records were documented by Vet 4 and 34 of these records were documented by Vet 6. I would recommend asking the vets to identify the breeds for these dogs [4], [5], [6]. I would not recommend removing these records, since they represent close to 40% of the entire sample. Additionally, there are only 2 dogs with Breed = T for Vet 3, 3 dogs with Breed = T for Vet 4 (assuming the records with the same age, gender

and breed represent one dog as described earlier) and 5 dogs for Vet 6. Therefore, it should be a quick and simple information request.

If the vets do not respond, I would assume the dogs with Breed = T for Vet 3 are Terriers, since this vet has some records with Breed = Toy. Also, I would assume the dogs with Breed = T for Vet 4 are Toy, since this vet has some records with Breed = Terrier. Although it would not be the preferred approach, I would recommend removing the 34 records with Breed = T for Vet 6, since there is no way of identifying which breed of dog these records belong to.

4. Potential Repetitive Entries

There are some records that are exact replicates of other records, meaning the records have the same VetID, DogID, Age, Gender, Breed VetProc, Billed$, DOS and ProcDesc. The details of these records are shown below (before any of my recommended changes were implemented), along with how many times these rows are repeated in the dataset.

# of Repeats	VetID	DogID	Age	Gender	Breed	VetProc	Billed $	DOS	ProcDesc
4	Vet3	40811	24	M	T	10	38	Year 3	Vet Visits
2	Vet6	41562	6	F	Hound	10	62	Year 3	Vet Visits
7	Vet3	61742	84	F	Hound	10	30	Year 3	Vet Visits
8	Vet6	74361	6	F	Other Purebred	10	80	Year 3	Vet Visits
8	Vet3	93915	24	F		20	40	Year 3	Specialist vet visits
4	Vet6	4089	9	F	T	20	148	Year 3	Specialist vet visits
2	Vet6	4089	9	F	T	20	185	Year 3	Specialist vet visits
2	Vet6	34348	3	F	Hound	20	66	Year 3	Specialist vet visits
2	Vet3	74770	12	F	Toy	20	41	Year 3	Specialist vet visits
2	Vet3	74770	12	F	Toy	20	50	Year 3	Specialist vet visits
7	Vet3	74770	12	F	Toy	20	52	Year 3	Specialist vet visits
2	Vet3	74770	12	F	Toy	20	64	Year 3	Specialist vet visits
2	Vet3	74770	12	F	Toy	20	65	Year 3	Specialist vet visits
5	Vet6	95236	7	F	Hound	20	75	Year 3	Specialist vet visits
2	Vet6	4489	1	F		10	135	Year 3	Vet Visits

# of Repeats	VetID	DogID	Age	Gender	Breed	VetProc	Billed $	DOS	ProcDesc
10	Vet6	10879	8	M	T	60	120	Year 3	Trmt - nonsurgical
4	Vet6	10879	8	M	T	70	450	Year 3	IP hospital
6	Vet6	10879	8	M	T	70	480	Year 3	IP hospital
2	Vet6	36321	9	F	T	10	62	Year 3	Vet Visits

For this scenario, it is possible for one dog to have the same procedure performed multiple times a year. For example, with the first record shown in the table, it is possible that the dog had to visit the vet four times in one year. Therefore, my recommendation is to keep all the records that appear to be duplicative, but to add a new field to the survey next year identifying the exact date of the procedure (MM/DD/YYYY). With this new field, we will be able to identify which records are in fact duplicates and should be removed.

5. Information requests

The information requests for the vets are summarized below. Because the veterinarians have limited incentive to participate, I have described my preferred recommendation and back up recommendation for each of these items, in case the vets do not respond.

Section	#	Vet	Question
1.2	1	Vet 4	There are 12 records with no information in the VetProc field. Please identify which procedures were performed.
1.3	2	Vet 3	What breeds are dogs with Dog ID = 93715 and 93915?
1.3	3	Vet 6	What breed is the dog with Dog ID = 4489?
3.3	4	Vet 3	What breeds are dogs with Dog ID = 40811 and 4624? (They are documented as Breed = T).
3.3	5	Vet 4	Please identify the breed for the dogs with Breed = T.
3.3	6	Vet 6	What breeds are dogs with Dog ID = 4089, 10879, 36321, 36461 and 86890? (They are documented as Breed = T).

TASK 2

Requirements to pass the task
Candidates must demonstrate recognition and understanding of key pricing metrics, formulas, and profit goals desired, and make informed decisions to arrive at key conclusions about their product's profitability. Candidates must provide a correct answer with support.

Common pitfalls:

- Incorrect answers.
- Unclear or missing support.
- Answers that demonstrate a lack of consideration of market forces, competitive forces, and distribution systems. As an example, in raising premiums to meet profit goals, a common pitfall is to discount the impact of your competitors, and their impact on your sales targets. Failure to consider the impact of cutting expenses to maintain profitability, which could impact the morale of the corporation due to re-distribution of the work and/or workforce.

Representative Solution A:

Attaboy Basic

1. Assumptions for Attaboy Basic were derived from our dear colleague Michelle. The assumptions can be summarized in the table below:

Assumptions		
Base Year Billed PMPM:	$18.98	
Annual trend:	10.6%	
# months of trend:	16	
Benefit Plan:	20.0%	coinsurance
	$1.00	deductible and limit costs
Fixed expenses pmpm:	$1.25	
Variable expenses as % premium:	10%	
Required profit as % premium:	6.2%	
Target loss ratio:	79.8%	

The formula to calculate the manual base premium is at below:

*Base Premium = [(Base Year PMPM Claim * Trend) – Cost Sharing] / Target Loss Ratio;*

Where:-
Trend : Annual Trend ^ (# months of trend/12)

Cost Sharing : *[(Base Year PMPM Claim * Trend) – Deductible and Limit Costs] * Coinsurance Percentage + Deductible and Limit Costs*

Inputting these assumptions into the formula results a manual base premium of **$20.77**, which yields us a profit level[1] of 4.2%; 2% lower than our required profit level.

[1]*Profit level is calculated by:*
Profit Level = Profit / Base Premium
Where:-
Profit : *(1 – Variable Expenses %) * Base Premium – Fixed Expenses – [(Base Year PMPM Claim * Trend) – Cost Sharing]*

It is noted that in our assumptions, a constant annual trend is currently used. There is possible room for improvement here as to split the annual trend into year 1 and year 2 trend. Given that the number of months of trend exceeds 1 year, it might be more appropriate to use first year trend for the first 12 months and second year trend for the next 4 months. This can be put up to discussion later with the team. However, moving forward with this exercise, I will maintain an assumption of 10.6% as a constant annual trend for now.

2. As mentioned in point 1, the manual base premium above does not attain the required profit level set by company policy. Certain actions could be taken to increase the profit percent to achieve our goal. I will list some of the possible actions below:

Possible Actions

1. Increase the manual premium
2. Increase the deductible imposed
3. Reduce the annual policy limit
4. Reduce the lifetime policy limit
5. Impose exclusions to reduce PMPM claim amounts
6. Impose a load (higher rating factor) on breeds with higher risk of high PMPM claims
7. Impose a load on age factors with dog ages of 7 and above
8. Decline very high risks such as terminally ill dogs with required ongoing treatment
9. Impose an underwriting requirement for ages 8 and above
10. Reduce the issue age maximum limit to up to age 7
11. Decline high-risks dog breeds (HNOTT, T, Toy)
12. Reduce commission to vets to reduce expenses
13. Increase member coinsurance percentage

3. To add on to point 2, my recommendation to the best action would be in the table below:

Recommended Actions	Justification
1. Increase base premium	Attaboy insurance can increase the base premium by assuming more conservative assumptions or impose a premium buffer.

		However, there is a risk that we lose market share to the competition because of our higher premiums.
2.	Impose an underwriting requirement for ages 8 and above.	From past PMPM claim data by dog age[2], we see that for dog ages 8 and above, the average claim for these ages are well above 25%. These dog ages are higher-than-average risks and should go through underwriting requirements.
3.	Impose a load (higher rating factor) on breeds with higher risk of high PMPM claims.	From past PMPM claim data by dog breeds[3], we can conclude that certain dog breeds are more prone to illnesses. It is a prudent strategy to impose an even higher rating factor on "T", "HNOTT" and Toy breeds as the PMPM claims for these breeds exceed 30%. This approach will not have a significant impact to our portfolio as the number of claims for these breeds are relatively low (< 10%) compared to other breeds.

[2]Past PMPM claim data by age

DogAge	*Number of Dogs*	*Proportion*	*PMPM*	*Age Factor*
0	*502*	*10%*	*18.01*	*0.949*
1	*503*	*10%*	*14.66*	*0.772*
2	*528*	*10%*	*18.78*	*0.990*
3	*545*	*11%*	*10.53*	*0.555*
4	*492*	*10%*	*16.56*	*0.873*
5	*511*	*10%*	*17.73*	*0.934*
6	*506*	*10%*	*18.61*	*0.981*
7	*449*	*9%*	*20.92*	*1.102*
8	*491*	*10%*	*24.47*	*1.289*
9+	*540*	*11%*	*29.74*	*1.567*
Total:	*5,067*	*Weighted-Average:*	*18.98*	*1.000*

[3]Past PMPM claim data by dog breed

Breed	*Number of Dogs*	*Proportion*	*PMPM*	*Breed Factor*
HNOTT	*302*	*6%*	*26.11*	*1.376*
Hound	*700*	*14%*	*18.30*	*0.964*
NonPurebred	*640*	*13%*	*7.41*	*0.391*
T	*163*	*3%*	*25.08*	*1.321*

Other Purebred	*544*	*11%*	*21.06*	*1.110*
Other	*868*	*17%*	*19.85*	*1.046*
Terrier	*434*	*9%*	*17.25*	*0.909*
Toy	*269*	*5%*	*26.58*	*1.400*
Total:	*4,996*	*Weighted-Average*	*18.98*	*1.000*

Attaboy Plus

4. By using the assumptions given to me in tab "Task2B Assumps" and targeting an internal rate of return (IRR) of 20%, I have managed to calculate the premium to be charged to the policyholder.

   Methodology

   The methodology used to calculate the premium is by a Discounted Cash Flow (DCF) method. A cashflow projection to calculate Distributable Earnings (DE) is created. The NPV formula of Microsoft Excel is used by using a rate of 20% (the IRR) to calculate the Net Present Value (NPV) of future DE. The goal seek built-in function of Microsoft Excel is then used to find the premium such that NPV = 0 under rate = IRR.

   Apart from the assumptions provided to me, I would like to clarify some further calculation methodology. Please refer the table below:

No.	Item:	Clarification:
1.	Attained Age	An attained age EOY is used, representing the Age Next Birthday (ANB) methodology. E.g.: a policyholder with issue age 0 is assumed to have an attained age = 1 in the first year of cashflow projection
2.	Average Reserve	The investment income is earned based on average reserve. Average Reserve is calculated by: *Average Reserve = (Reserve BOY + Reserve EOY) / 2*
3.	First Year Exp	First year expense is inclusive of maintenance expenses of $5, as the policy still needs to be maintained in the first year
4.	Premium	The premium calculated is rounded off the nearest 2 decimal points using the ROUND Excel function, as it is impossible to charge the policyholder up to 3 decimal points.

   Findings:

   The calculated premium for issue ages 0, 5 and 10 can be found below:

Issue Age:	Calculated Premium:

0	$ 48.27
5	$ 72.00
10	$ 127.40

5. Gross premium reserves are principle-based reserves while the given reserves by management are rule-based reserves.

   There are differences in these two reserves which will have impact on the pattern of distributable earnings.

   Rule-based reserves cannot be less than zero; probably due to the use of conservative assumptions or regulatory restrictions of negative reserves. Since these factors are given by management, it is unclear to us how it is calculated.

   Gross premium reserves on the other hand, can be negative. This is usually the case in the initial years due to higher initial expenses in the first year, followed by reserves build-up over time and eventually decreases as the portfolio runs off.

   Distributable earnings is derived from premium income plus all investment income, minus all benefit outgoes, minus taxes and minus change in reserve and target surplus. If we were to substitute the given reserves with gross premium reserves, the change in reserve, investment income, target surplus and tax component will change. As the other cashflow components are dependent on the reserve amount, the main driver of the difference in the pattern of the distributable earnings would be the change in reserve.

   If the change in reserve in gross premium reserves held at any point of time is lower than the rule-based reserves given by management, distributable earnings would be higher and vice versa.

Representative Solution B:

Part A: Attaboy Basic –

A1 –

Based on first year sales data of Attaboy basic, following information is available to our company:

Assumption	Value
Base year billed PMPM	$18.98
Annual trend	10.6%
Number of months of trend, based on projected sales data	16
Coinsurance factor	20%
Deductible and limits PMPM cost	$1.00
Fixed expenses PMPM	$1.25
Variable expenses as a % of premiums	10%
Required profit margin, company policy	5.7%
Target loss ratio (TLR), company policy	79.2%

1. The first step of calculating base premium involves projecting the base year billed PMPM to projected sales date for the policy based on annual trend assumption.
2. This initially requires converting the annual trend rate figure to a monthly amount and then using it to calculate the expected trend over a 16 month period –

Annual trend (yearly): 10.6%
Trend (till projection): (1 + 10.6%)^(16/12) = ***1.144***

3. The above rate is used to calculate trended billed PMPM amount till the projection sales date as -

*Trended billed PMPM = Base year billed PMPM * Trend (till projection)*
*= $18.98 * 1.144*
= $21.72

4. Since the plan includes a coinsurance arrangement of 80% (paid by insurer) / 20% (paid by policyholder) and a fixed deductible, the trended billed PMPM amount calculated above is reduced by the cost shared by policyholders as follows –

*Cost sharing = deductible and limits PMPM cost + (trended billed PMPM – deductible and limits PMPM cost)*coinsurance factor, hence*
*Cost sharing = $1.00 + ($21.72 -$1.00) * 20%*
=$5.14

5. The total projected company health claim cost is then simply calculated as –

Projected health claim cost = trended billed PMPM – cost sharing
= $21.72 - $5.14 = ***$16.57***

6. Premium to achieve company's TLR of 79.2%, is then calculated by dividing projected health claim cost with the TLR –

Premium to achieve TLR: projected health claim cost / TLR
= $16.57 / 79.2%
=$20.92

Hence, given the assumptions and TLR level, the manual base premium for Attaboy basic benefit plan comes out to be **$20.92.**

7. The above premium leads to an overall profit level of **4.8%,** which appears to be lower than company's internal target of 5.7%. The calculation of profit level achieved is as follows –

Profit level achieved = 1 – (total costs / base premium)
*= 1 – ((projected health claim costs + fixed expenses PMPM + variable expenses as a % of premium * base premium) / base premium)*
*=1 – (($16.57 + $1.25+ 10% * $20.92) / $20.92*
=4.8%

8. Reasonability check on profit –
   Total expenses for the company are equal to $3.34 (fixed expenses PMPM + variable expenses as % of premium). Hence **16.0%** of total premium is used for paying company's expenses.
   And since claim costs cover the TLR level of **79.2%,** a total of **95.2%** (16.0% + 79.2%) of base premium is used for paying company outgos thus remaining 4.8% represents the profit achieved by Attaboy.

A2 –

The manual base premium calculated based on initial assumptions is not able to achieve required profit target for the company. To increase the profit percentage, Attaboy could take the following actions –

- The company could keep base premium unchanged and try to increase profits by–
  - Targeting a different mix of business e.g. greater exposure to 'Nonpurebred' breed and lesser to 'Toy' breed, or by better underwriting practices, which can lead to lower base year billed PMPM costs for the company and higher profits.
  - Increasing coinsurance and deductibles which would mean that policyholders need to pay a higher proportion of individual claim amounts out of their pockets. This leads to lower claim costs and larger profits for Attaboy.
- The other option is to increase the base premium by taking following actions –
  - Base year billed PMPM cost can be increased by targeting a different mix of business by breed or by age. E.g. If lesser of 'Nonpurebred' breed and more of 'Toy' breed is included then, higher PMPM costs can lead to higher profits if premium is calculated by targeting same TLR.
  - Reducing coinsurance and deductibles would mean that Attaboy needs to pay a higher proportion of claim amount thus leading to higher premiums and subsequently higher profits.
  - Reducing TLR would lead to higher premiums for same claim costs, thus leading to greater profits.
- Another option for the company is to reduce its variable and fixed expenses. This action is expected to increase profitability irrespective of whether company charges base premium as calculated in part 'A1' or increases premiums by the options discussed above.

A3 –

Following are our recommendations on the options discussed above –

- The most appropriate action according to our analysis is to reduce the fixed and variable expenses as it helps the company in improving its profit levels without any changes to the premium calculated. Currently around 16% of total premium is used for paying company expenses. If this proportion can be reduced, then any savings realized will contribute in increasing company profits. The action can be achieved by building expense efficiencies within the company, reducing any redundancies and trying to build synergies within different business units. Further, since each vet is compensated on a dollar per policy basis for Attaboy basic, the company could collaborate with different vets and any other distribution channels with lower expenses. The key risk with this approach is that if dollar per policy compensation is reduced significantly then existing vets could go with other competitors thus impacting Attaboy's sales.
- Reducing coinsurance and deductibles can increase profits through higher premiums (based on same TLR). Reduction of these variables implies that policyholders need to pay a lower proportion of claim costs out of their pockets and can thus help the company in improving the marketability of its Attaboy basic plan. However

a corresponding increase in premiums might offset this impact and hence we would recommend the company to consider other factors such as current level of premium against industry levels, its competitive position in the market, coinsurance and deductible limits of other similar products in the market, and the demand elasticity of customers to increase in premiums vs. coinsurance and deductible limits.
Similar analysis needs to be performed if the company would like to consider the other option of keeping premiums constant but increasing coinsurance and deductibles as it can to lead to poor marketability for product.

- The company could also consider the option of exploring different target markets to improve its profits. Different dog breeds, dog ages etc. could be tested to perform detailed cost benefit analysis of these options. Again the company should consider industry trends and its competitors while considering this option.
- We would also recommend the company to strengthen its underwriting procedures. It would ensure that company takes on only those risks which can be supported by the base premium. Very high risk policies leading to large claim losses can be avoided or charged appropriately. The key risk with the option is that increase in profits due to lower claim costs will be slightly offset by higher expenses of following better underwriting practices.
- Changing the TLR might not be easy to implement in the short term as it is a company policy based on past experience, and hence can only be changed after approvals from all stakeholders and changes in observed experience.

Part B: Attaboy Plus –

B1 –

Attaboy insurance wants to calculate required premium for issue ages 0, 5 and 10 for its Attaboy plus plan by targeting a 20% IRR on distributable earnings. The following assumptions were shared with our company by Attaboy's management–

Assumption	Value
Annual lapses	4.5%
Acquisition expenses (% premium)	20%
Maintenance expenses (per year per policy)	$5
Target surplus (TS) (of reserves)	3%
Tax on earnings	35%
Rate of return on reserve and target surplus - RoR	5%
GPV discount rate	5%
Mortality assumptions varying by attained age	
Reserves per $1 of insurance varying by issue age and duration	
Timing of cashflows	

Based on above assumptions, the required annual premium for issue ages 0, 5, and 10 can be seen in the table below –

Issue Age	Required annual premium
0	$57.14
5	$72.16
10	$122.20

Key points regarding methodology used for calculating required premium above are specified below –

1. The first step of premium calculation involves estimating future in-force, death and lapse probabilities which are multiplied by corresponding incomes / outgos amounts to estimate the future cashflow projection after allowing for decrements.
2. The distributable earnings, which are targeted to provide an IRR of 20.0%, are defined as (These can be seen in Appendix 1 below)–

Distributable earnings = after tax income + inv. income on TS – increase in TS – taxes on inv. income on TS, where

*After tax income = ((premium - expenses) * (1 + RoR) + inv. income on reserves– death benefit – increase in reserves) * (1 – tax rate)*

3. Investment income on reserves and TS is calculated on average reserves / TS over the year, and roll forwarding the amounts to end of year by earning the RoR for 0.5 years. Similarly since premium and expenses occur at start of year, their net contribution earns the RoR for 1 year, as seen in the after tax income calculation above.
4. Overall, the required premiums increase as issue age increases which seems reasonable due to higher mortality and per policy reserve rates for older issue ages.

B2 –

Assuming that the reserves determined by Attaboy's management are net premium reserves, then the pattern of distributable earnings would turn out to be different if gross premium reserves are used instead.

Net premium reserve is the amount of money that a company holds so as to cover future benefit payments, without making any allowance for company expenses as expected under its reserving basis and after allowing for future net premium income. Gross premium reserves on the other hand represent the amount of money that a company needs to hold to cover future benefit and expense outgos as expected under its reserving basis and after allowing for future gross premium income. Hence the gross premium reserves are expected to be higher in amount than net premium reserves.

Over the duration of the policy these reserves are released and contribute to distributable earnings in the future. So if higher gross premium reserves are held instead of given reserves, the pattern of distributable earnings would change in the sense that distributable earnings in initial years would be reduced whereas distributable earnings in future years would be increased, as these higher reserves are released over time. So overall, the total distributable earnings over the term of the contract would still be similar but company's IRR would reduce as these earnings are now being released later in the future.

Appendices

Appendix 1 – Distributable earnings for each issue age at base premium–

Year	Issue Age 0	Issue Age 5	Issue Age 10
1	$ (10.98)	$ (6.08)	$ (8.02)
2	$ 4.28	$ 2.97	$ 5.29
3	$ 3.62	$ 2.25	$ 3.01
4	$ 3.00	$ 1.63	$ 1.61
5	$ 2.43	$ 1.12	$ 0.84
6	$ 1.93	$ 0.72	$ 0.45
7	$ 1.49	$ 0.44	$ -
8	$ 1.11	$ 0.25	$ -
9	$ 0.80	$ 0.14	$ -
10	$ 0.55	$ 0.08	$ -
11	$ 0.35	$ 0.05	$ -
12	$ 0.21	$ -	$ -
13	$ 0.12	$ -	$ -
14	$ 0.06	$ -	$ -
15	$ 0.03	$ -	$ -
16	$ 0.01	$ -	$ -

TASK 3

Requirements to pass the task
Candidates must demonstrate an understanding of key pricing variables along with their sensitivities (or boundaries) and interdependencies. Candidates must provide adequate support for their work.

Formulaic Approach

For method one, the solutions are:

$$\text{PMPM} = \frac{1.25(0.9P - 0.25)}{(1+T)^{4/3}}$$

$$\text{Trend} = \left[\frac{0.9P - 0.25}{0.8(18.98)}\right]^{0.75} - 1$$

$$\text{deductible/limit} = 0.8(18.98)(1+T)^{4/3} + 1.25 - 0.9P$$

For a trend of 10% and a premium of $20, the answers are $19.54, 12.42%, and $0.49 respectively.

For method two, the solutions are:

$$\text{PMPM} = \frac{1.125P - 0.5625}{(1+T)^{4/3}}$$

$$\text{Trend} = \left(\frac{1.125P - 0.5625}{18.98}\right)^{0.75} - 1$$

$$\text{deductible/limit} = 18.98(1+T)^{4/3} - 1.125P + 1.5625.$$

For a trend of 10% and a premium of $20, the answers are $19.32, 11.47%, and $0.61 respectively.

Common pitfalls

- Incorrect calculations
- Unclear or missing explanations
- Failure to identify mortality as the most critical assumption

Representative Solution A:

A1. Sensitivity analysis has been performed for several key assumptions for Attaboy Basic. The Break-even point is defined as the level of the assumption where the product would be expected to have zero profit. If the assumption strays beyond that point, the product will be expected to lose money. The table below shows the break-even points for tested assumptions.

Assumption Tested	Base Assumption	Break-even Point
Base Year PMPM	$18.98	$19.60
Annual Trend	10.6%	13.36%
Coinsurance Percentage	20%	15%
PMPM Value of Deductible and Annual Limits	$1.00	$0.45

The break-even point is the point where profit equals zero. Profit can be defined by the following formula.

Profit = Premium– Expenses – Loss

Only assumptions that are part of the Loss were tested. Profit will be zero when Premium minus Expenses equal Loss. Premium was determined to be $20.20 and Expenses are expected to equal $3.27. Thus, the break-even point occurs when Loss equals $16.93. Assumptions were varied one at a time using the Excel Goal Seek function to find the point at which Loss equals $16.93. Loss is calculated using the following formula.

Loss = Base Year PMPM * (1 + Trend) ^ (16/12) * (1 – Coinsurance) – Value of Deductible/Limits

The following is an example of the calculation of the break-even point for Base Year PMPM. Notice $19.59 is used instead of the base $18.98 to produce a Loss of $16.93.

$16.93 = $19.60 * (1 - .106) ^ (16/12) * (1 - .2) - $1.00

A2. Base Year PMPM is the most critical of the assumptions tested. Just a 3% increase from the base level causes an expected loss on the product. The importance of Base Year PMPM is not surprising. Other assumptions related to expected Loss are relatively minor adjustments made to the Base Year PMPM assumption.

B1. Pricing assumptions for Attaboy Plus were sensitivity tested. The table below shows the level of each assumption at which the IRR equals 5%.

Assumption Tested	Base Assumption	Assumption Value at which IRR = 5%		
		Issue Age 0	Issue Age 5	Issue Age 10
Mortality Constant[1]	100%	105%	103%	101%
Lapse Rate	3%	0%*	0%*	0%*
Acquisition Expense	20%	38%	26%	22%
Maintenance Expense	$5.00	$7.20	$6.00	$ 5.50
Rate of Return[2]	5%	-1.50%	-1.61%	-0.36%

[1] Mortality rate at each age multiplied by the same constant

[2] Rate of return on reserve and target surplus

*IRR did not drop to 5% by varying the lapse rate at any point between 0% and 100%

B2. It is appropriate to only vary these five assumptions one at a time. The main purpose of these tests was to determine which assumptions are the most critical to correctly pricing the product.

Varying assumptions together should be considered if those assumptions are thought to be interdependent. However, the assumptions tested for Attaboy Plus appear to be independent.

B3. It would be appropriate to vary the Interest Rate and Maintenance Expense assumptions by policy year. No other assumption should vary by policy year.

Mortality rates in life insurance sometimes vary by policy year. This is often in the form of select mortality factors that lower mortality table rates in early policy years to reflect better than average health ensured by the underwriting process. Attaboy Plus does not have underwriting, thus there should be no adjustment for select mortality.

Life insurance lapse rates typically start at a higher rate then decrease to a lower, stable rate as policy years go by. Attaboy Plus lapse rates are more likely to follow this pattern than have level lapse rates as currently assumed. Higher lapse rates in early years could affect the profitability of the product since expenses are front weighted.

Acquisition expense for Attaboy Plus is first year only, so has no need to vary by policy year.

Maintenance expense assumptions often increase by policy year to reflect inflation or other changes in administrative costs. It would be simple to modify the Maintenance expense assumption to incorporate an inflation rate.

Rate of Return assumptions will sometimes vary by policy year. Often this accounts for differences in expected short term and long term expected earned rates. The relatively short lifespan of the Attaboy Plus product means rate of return is not as important to profitability as it is on typical life insurance products. The sensitivity test shows that the product does not rely on investment returns. It is not necessary to develop a more sophisticated rate of return assumption.

B4. Mortality rate and maintenance expenses are the two most critical assumptions.

Attaboy Plus is extremely similar to a whole-life insurance policy. Unless a lapse occurs, the death benefit will be paid to each policy holder. Increases in mortality rates mean benefits are paid sooner and fewer premiums are received. Testing showed the IRR for this product is highly sensitive to small increases in mortality rates.

Maintenance expenses are also a critical assumption for Attaboy Plus. The IRR was shown to be relatively sensitive to changes in the maintenance expense assumption. This will be exacerbated by the recommendation from the previous section to have the maintenance expenses increase by policy year for inflation. If that change is made the product will become more sensitive to increased maintenance expenses, especially for policies with low issue ages that are expected to have longer lifespans.

Representative Solution B:

Attaboy Basic Sensitivity Testing:

A sensitivity test was conducted on the Attaboy Basic pet medical insurance plan by finding each assumption's breakeven point that causes the product to lose money. For this sensitivity test, each of the four critical assumptions in the table below was varied independently while the other assumptions (and the charged premium of $20.52) were held constant. The results of the sensitivity test can be found below.

Attaboy Basic Sensitivity Testing		
Assumption	***Best Estimate***	***Breakeven Value***
Base Year PMPM	$18.98	$19.70
Annual Trend	10.6%	13.7%
Coinsurance	20.0%	16.9%
PMPM Value of Deductible	$1.00	$0.19

The table above shows the level of each assumption that produces a negative profit, all else equal. These calculations were performed using the Goal Seek function within Excel.

Of these assumptions, base year PMPM is the most critical. A slight increase of $0.71 in base year PMPM cost (or 3.7% of the original estimate) is enough to drive profits negative. This is the most sensitive assumption by a wide margin since this small change drastically affects the performance of the product. The base year PMPM assumption should be carefully evaluated during the assumption-setting process to ensure that it is both appropriate and reasonable for use in this pricing model.

The assumptions for annual trend and PMPM value of the deductible require significant changes to reach the breakeven point (29.2% and -81.0%, respectively), so these assumptions are not as critical relative to base year PMPM. Profit is somewhat vulnerable to fluctuations in coinsurance; however, the level of the plan's coinsurance is defined in the policy terms. This means that this assumption is unlikely to change frequently. The limited sensitivities of the other assumption echo the sentiment that base year PMPM is the most critical assumption.

Attaboy Plus Sensitivity Testing:

A sensitivity test was also conducted on the Attaboy Plus product using a similar methodology. Five separate assumptions were individually changed to achieve a decreased IRR of 5%, with the others (in addition to premium at each issue age) being held constant. This process was repeated for each of the three issue ages (0, 5, and 10). The sensitivity test results (found with Goal Seek) are below.

Attaboy Plus Sensitivity Testing								
		Issue Age 0		**Issue Age 5**		**Issue Age 10**		**Average**
Assumption	***Best Estimate***	***Value at IRR = 5%***	***Change in Assumption***	***Value at IRR = 5%***	***Change in Assumption***	***Value at IRR = 5%***	***Change in Assumption***	***Change in Assumption***

Mortality x Constant	1.00	1.06	6.2%	1.03	3.0%	1.02	2.2%	***3.8%***
Lapse Rate	3.33%	-5.03%	-251.2%	-0.80%	-123.9%	-4.46%	-233.8%	***-203.0%***
Acquisition Expense	20.00%	38.67%	93.3%	27.07%	35.4%	23.53%	17.6%	***48.8%***
Maintenance Expense	$5.00	$7.13	42.6%	$6.26	25.2%	$6.59	31.8%	***33.2%***
Rate of Return on Reserve & Surplus	5.00%	2.08%	-58.4%	3.54%	-29.2%	3.60%	-28.0%	***-38.5%***

Interactivity Between Assumptions:

- While the sensitivity test does provide some insight as to which assumptions are most critical, it neglects to account for the impact that assumptions can have on one another. There are indeed cases where it is more appropriate to vary certain assumptions together.
- In some cases, an increase in one assumption could lead to a decrease in another, changing the effect an initial assumption's change will have on a product's performance. For example, if maintenance expenses are increased to provide policyholders with a better customer service experience, lapses will likely be reduced as a result. The ensuing decrease in lapses could potentially boost profitability despite the increase in expenses, depending on whether the product is lapse-supported.
- An alternative example could include an increase in dogs' mortality causing policyholders to lapse less frequently. Though an increase in mortality would not be favorable for Attaboy, the decrease in lapses could be, depending on the structure of the product.
- By varying some assumptions together and running scenario tests, deeper, more realistic insight can be gained as to the effects of changes in assumptions.

Varying Assumptions by Policy Year:

- Assumptions are usually set uniformly across all policy years. However, this may not necessarily be the most realistic way to set assumptions, as policyholder behavior (among other things) can change over time. As a result, there are instances where assumptions should vary by policy year.
- One assumption that should vary by policy year is the lapse rate. Lapses should be higher in the first year of the policy, as some policyholders may not find the coverage worthwhile. After the first year, lapses will likely decrease over the life of the policy as the maximum lifespan of dogs is not very long and owners may sense when their dog is close to death. Assuming varying lapse rates could point out potential issues with the structure of the Attaboy Plus product.
- Other assumptions already vary somewhat from year to year. Mortality rates are calculated based on the increasing age of a dog over time. Acquisition expense is only applicable to the first policy year. The remaining assumptions, maintenance expense and rate of return, are better suited as averages.

Most Critical Assumptions:

- The most critical assumptions for the Attaboy Plus product are the mortality rate at each age (multiplied by a constant) and the maintenance expense.

- Based on the results of the sensitivity test, the mortality rate is by far the most vulnerable to fluctuations that significantly affect the performance of the product. Over the three tested issue ages, an average increase in mortality of 3.8% was enough to decrease the IRR of the product from 20% to 5%. This assumption required the smallest change to reach the lower IRR. Mortality rates are important as they anticipate the frequency and timing of death benefits. Therefore, they should be carefully set based on the highest quality data available.
- Maintenance expense is the second most critical assumption for the Attaboy Plus product. Across all three issue ages, an average variation of 33.2% in maintenance expense caused the product to decrease to an IRR of 5%. This is the second-lowest assumption deviation required to produce the decreased IRR. Maintenance expenses are likely critical because they reduce the percentage of premium available for profit consistently across all policy years.
- All other assumptions require a more significant average variation to reach an IRR of 5%, meaning that they are not as sensitive to fluctuations. Of note, Attaboy Plus's performance is so insensitive to lapse rates that the required lapse rate to reduce the IRR to 5% is negative for all issue ages. This is not realistic (negative lapses cannot occur), meaning that lapse rates cannot substantially affect the product's profitability.

TASK 4

Requirements to pass the task
The risk categorization and definition matrix must be used. Organized structure with three pertinent risks in each major risk category. Risk definitions explicitly demonstrate the relevance of the risk to Attaboy's situation. Risk mitigation recommendations are clear and realistic.

Potential pitfalls

- Risks that do not have any bearing on Attaboy, or whose relevance to Attaboy is not made clear.
- Unclear or no mitigation recommendations.
- Unorganized structure from which it is difficult for the reader to retrieve information.

Example Memorandum
To: Project Lead
From: FAP Candidate
Date: August xx, 2020
Subject: Risk Identification and Mitigation

Attaboy Insurance tasked Risk-A-Verse with reviewing risks that Attaboy could face and how they apply to their current line of pet health insurance and pet life insurance. The RCD tool shown below lists three risk subcategories relevant to the two pet insurance products for each of the major risk categories:

Major Risk Category	Risk Subcategory	Definition
Financial	Market	Unexpected changes in external financial markets (such as stock markets), market prices for pets, and interest rates. Such changes will influence the value of pets and investment assets value on the Attaboy's balance sheet. If interest rates decline, the assumption of the rate of return on reserve and target surplus for Attaboy Plus will not be met.
Financial	Credit	Unexpected changes in the risk of default and change in the credit quality of issuers of securities, counterparties and intermediaries. This could impact specific fixed-income securities on Attaboy's balance sheet.
Financial	Liquidity	Unexpected changes in liquidity supply or demand. Attaboy Insurance runs the risk of not being able to pay claims if there are more claims than expected at any given time. They may not have enough liquid capital on hand to pay claims and might be forced to make untimely asset sales if money is tied up in long term investments or in options with no ability to exercise early.
Strategic	Economic	Unexpected changes in the economy. In an economic downturn, Attaboy Insurance's sales will likely decline because consumers will have less disposable income. Fewer people will purchase pet insurance and more existing consumers will allow their pet insurance policies to lapse.
Strategic	Competitor	Unexpected change in competitive landscape, such as new entrants to the pet insurance market or competitors intentionally issuing policies at lower prices regardless of profitability.

Major Risk Category	Risk Subcategory	Definition
Strategic	Legislative/ Regulatory	Unexpected changes in insurance regulations or laws. Pet insurance regulations would be the primary source of this risk for Attaboy. One example would be reserving regulation changes for pet insurance requiring higher reserves.
Insurance	Pricing	Pricing risk is the risk that insurance products are mispriced, either underpriced or overpriced. If Attaboy's experience differs from the assumptions used to price premiums, then there could be higher costs than expected, and profitability would be impacted
Insurance	Policyholder behavior	This is the risk that policyholders act in unexpected ways that have a negative impact on Attaboy. For example, policy holders of Attaboy Basic may be more likely to bring their dogs in for medical issues than other dog owners, because they know the costs would be covered.
Insurance	Underwriting Risk	Inaccurate assessment of the risks associated with writing a pet insurance policy. Attaboy faces risk because they do not require the pets they insure to go through a rigorous underwriting process. Attaboy does not underwrite risks, instead rating dogs solely based on their breed and age. Anti-selection could occur, resulting in a higher-risk pool.
Operational	Human resources	Unexpected changes in the talent pool, e.g. losing key senior management, poor productivity, or poor conduct. If Attaboy's employees leave or are not performing as expected, there could be significant impacts to company performance.
Operational	Technology	This is the risk that Attaboy's technology is not performing as expected. If there are failures, Attaboy may have difficulty processing and paying claims, developing and pricing new products, or valuing reserves.
Operational	External Fraud Risk	Unexpected change in the amount of fraud by external parties. For Attaboy, there is a risk of fraud especially on their Attaboy Plus plan. There is no formal way of tracking when pets die, policy holders could submit false claims.

The following subcategories are the most important for mitigation in each major risk category:

- *Liquidity risk in financial risk:* Because Attaboy is a type of health insurance company, it will need to pay claims on a relatively frequent basis. Since it isexposed to the possibility of increase in the frequency or severity of claims, Attaboy must keep sufficient high-quality liquid assets on hand. The company should hold a separate liquid capital reserve that is not invested in long term investment instruments to ensure they will have adequate capital on hand if it is needed.
- *Legislative risk in strategic risk:* Currently the pet insurance market is not subject to regulations and it is likely that in the future new regulation will be put in place. It is recommended to have Attaboy Insurance's legal team monitor potential new legislation. If adverse regulations are being proposed in specific states, Attaboy should proactively engage legislators to educate them on insurance principles.
- *Pricing risk in insurance risk:* If Attaboy does not price its products adequately and appropriately, it may take only a short amount of time for the company to go bankrupt. Attaboy can mitigate pricing risk by frequently conducting experience analysis on assumptions used in the pricing process, such as mortality rate and lapse rate. It is recommended that the company develop a process to swiftly incorporate significant changes into its pricing.
- *Human resources risk in operational risk:* Pet insurance is an emerging market and Attaboy should expect new entrants to the market. As competitors enter, they often build their initial teams by poaching experienced employees from mature companies. It is recommended that Attaboy

implement a process for continuous employee feedback to identify potential reasons an employee might want to leave, so that the company can target areas for improvement in employee retention.

TASK 5

Requirements to pass the task
Candidates should understand how experience analysis impacts future pricing performance, be able to recognize key assumptions that are key drivers of results, and provide assumption updates in order to align with actual experience, including making appropriate recommendations with support.

Potential pitfalls
- Unclear or missing recommendations.
- Unclear or missing support.

Example Memorandum
To: Actuarial Team
From: FAP Candidate
Date: August xx, 2020
Subject: Attaboy Basic Experience Review

Summary:
One year following the initial sale of the Attaboy Basic product, experience data has been obtained. I completed an actual to expected analysis to assess the appropriateness of the assumptions used during the ratemaking process. I recommend making changes to the base PMPM and the age and breed factors. I propose introduction of two additional factors, and explain why we cannot yet evaluate the trend assumption.

Base PMPM Experience Review:
The base PMPM cost established in the rating manual was $21.57. When we look at the experience data, we see that the base PMPM was instead $23.70, resulting in a difference of $2.13, or 9.9%. In other words, experience was significantly worse than anticipated. I recommend adjusting the base PMPM.

For this adjustment, the standard for full credibility has been set to 150,000 member months, per actuarial judgment. Typically, the standard for full credibility is based on a smaller number of exposures or claims, but this number has been deemed suitable because the product is new. More extensive credibility studies can be performed in the future if desired.

The credibility factor (Z) is calculated as the square root of the current amount of experience divided by the standard for full credibility. In this case, 85,601 member months of experience data are available. This means that Z is the square root of (85,601/150,000), or 0.7554. To determine the updated premium, the credibility factor is applied to the average experience PMPM while the complement of the credibility factor is applied to the manual rate. The sum is taken to reflect the updated base PMPM (Z*($23.70) + (1-Z)*($21.57)), which is equivalent to $23.18.

Rating Factors Experience Review:

At the moment there are two rating factors, the age factor, and the breed factor. For the age factor, the PMPM is calculated by dividing the claims amount by the average dog count at each dog age. The same goes for the breed factor where the claims are divided by average dog count per breed. Below are the original factors next to the ones generated by the experience.

Age Factor			
Dog Age	Original Factor	Experience Factor	% Difference
0	0.943	0.926	-1.72%
1	0.768	0.824	7.18%
2	0.789	0.771	-2.21%
3	0.830	0.833	0.38%
4	0.871	0.919	5.49%
5	0.943	0.891	-5.48%
6	0.973	0.999	2.64%
7	1.127	1.129	0.17%
8	1.281	1.255	-2.00%
9+	1.537	1.534	-0.21%

Overall, the manual factors are a fairly accurate representation of the role of dog age on PMPM costs. Most deviations between the manual and experience factors are within 5%. Therefore, no changes are recommended to the rating factors for dog age.

Breed Factor			
Breed	Original Factor	Experience Factor	% Difference
Hound	1.250	1.467	17.40%
Non-Purebred	0.750	0.278	-62.92%
Other Purebred	1.000	1.155	15.49%
Terrier	0.900	0.985	9.42%
Toy	0.900	0.847	-5.83%

When compared with the breed rating factors from the manual, discrepancies are apparent. The table above shows that all experience factors deviated by 5% or more. As a result, I recommend all dog breed demographic factors should be modified to match experience. Non-purebred dog owners will benefit from a discount in their premiums. This discount will attract more clients that own non-purebred dogs. Also, increasing the premiums for owners of hound dogs will protect Attaboy Insurance against the risk of adverse selection.

Adding or Deleting Rating Variables:

Of the two current rating variables in use (dog age and breed), I recommend not to delete either. Based on the demographic factors calculated from the first year of experience, there are consistent, notable associations between the status of these rating variables and the claim experience of dogs.

In addition to the current age and breed factors, I propose introducing factors by veterinarian office. Some veterinarians may incur higher costs compared to their competitors. As a result, dogs that are cared for by a particular veterinarian may experience higher or lower claims,

depending on the provider. I also propose a geographic factor be introduced. Dogs in a rural area may be healthier than the ones in the city because they spend more time running outside. In addition, adding a geographical location factor might help increasing sales in some new regions. The data to develop these factors is already available to Attaboy and can be researched and tested to determine whether this association is significant. If so, it can be implemented to further increase the predictive ability of the pricing model.

Evaluating Trend Experience:

When evaluating the trend assumption, it is important to divide the base PMPM generated by the experience by another base PMPM that would have been generated by the experience. The first base PMPM was determined based on veterinarian data from dogs with no health coverage, and assumptions coming from the marketing team, management, and some experts in animal health. The two base PMPM do not share the same basis. The trend assumption should strictly be calculated by taking the ratio of two analogous experience periods.

TASK 6

Requirements to pass the task
Candidates should demonstrate understanding of how to write a formal communication with their target audience in mind. Each recommendation and its support should be clear and easy to find.

Potential pitfalls
- Unclear or missing recommendations.
- Overly wordy and/or overly technical for target audience.
- Poor organization.

Example Memorandum
To: Attaboy Insurance Management Team
From: FAP Candidate
Date: August xx, 2020
Subject: Proposed modifications to the Attaboy Plus coverage

Executive Summary

A year ago, Attaboy Insurance launched two products to provide dog owners financial security by mitigating the risk of incurring significant expense to treat ill or injured pets. The market for pet insurance has been booming due to expensive medical techniques, new drugs, and pet owner's having higher expectations for their pets' health care and standard of living. The current Attaboy Plus product provides a lump sum death benefit of $250 when a covered dogs dies. Management is considering the following modifications to the Attaboy Plus coverage.

A. An accidental death rider
B. A separate coverage for high-value dogs
C. A preferred risk class
D. Expansion of sales

I recommend that Attaboy Insurance's Management Team further consider the accidental death rider and the expansion of sales. The remaining two ideas, separate coverage for high-value dogs and offering a preferred risk class. do not provide enough benefit for the potential key risks associated.

Recommendations

Commentary on recommendations:
There may be more than one appropriate answer for each recommendation.

<u>Accidental death rider</u>

The accidental death rider would provide an additional $250 if the death is due to an accident rather than illness or old age. I recommend this modification.

Accidental death riders have been in the market for human life insurance for a long time. Thus, it will be appealing to consumer to have accidental death riders for dogs too. Attaboy can increase market share by giving consumer this added product choice. Additionally, accidental death riders have been a profitable product for many years.

Key risks of adding this rider include:

1. A higher frequency rate than human accidental life insurance. Dogs tend to be more involved in accidents as they lack the human understanding of the world.
2. Lack of data to determine the initial price the product. It is a potential loss-making product if it is mispriced or if sales are lower than expected.
3. This rider could become used as a fraud scheme if there is no way to verify the occurrence. Additionally, this may lead to animal abuse.

<u>High Value coverage</u>

The separate coverage for high-value dogs, such as show dogs and racing dogs, would provide a death benefit of $10,000. I do NOT recommend this modification.

Similar to high net worth life insurance, dogs with high value could be insured too in case of any unfortunate event. This separate coverage could be extremely desirable for owners of show and racing dogs. With a larger death benefit, there will be increased premiums and more earning potential when Attaboy invests the money. Also, I expect a show or racing dog will be better cared for and live a long life, since their owner will spend the time and money to ensure they can continue participating in shows and races. Life insurance is more profitable when the dog lives a long life because there will be more premiums paid than a dog with a short life.

However, the current distribution channel does not include show or racing dogs. Currently, Attaboy Plus is sold by veterinarians. Perhaps show and racing dogs have their own personal vets, who aren't connected to Attaboy Insurance. Entering this space would be highly competitive and niche.

Additionally, this modification has the potential to incur large losses. A higher cash reserve will be required, and there could be large losses in the event of a catastrophe in a dog show or race (multiple insured high value dogs claim at once). With limited data on show and racing dogs, there is a high risk of mispricing. If Attaboy Insurance choose to pursue this modification, I recommend that the company engage in reinsurance services if they are available since the risk exposure is high.

<u>Preferred risk class</u>

The increased benefit for dogs in a preferred risk class would allow purchasers the option of buying up to $1,000 in benefit, if their dogs pass a comprehensive health examination. I do NOT recommend this modification.

The key benefit to offering a preferred risk class is policyholder appeal. Another benefit would be increased profits, if the dog actually lives a long and healthy life.

However, for dogs that are family pets, we do not think passing a comprehensive health examination will predict a long life. A dog can be perfectly healthy and pass the comprehensive health exam, but the next day get into a dangerous situation and die (e.g., run in front of a moving vehicle, walk across ice that is not fully frozen, eat a poisonous plant, etc.). Additionally, policyholders will expect to be paying less premiums now that they are in a preferred risk class. This means we now charge less premium per $1 and allow the policyholder to increase the death benefit, but a comprehensive health examination will increase administration costs for Attaboy.

Sales Expansion

This modification will expand the sales from veterinarian offices to large chain pet stores. I recommend this modification.

Currently, Attaboy Insurance has only one channel to sell their insurance products. If Attaboy Insurance expands their distribution channel to large chain pet stores, Attaboy Plus will get more visibility and customer convenience will be improved. More customers means more sales and more distributable profit. Additionally, the customers are likely to be more dispersed geographically, so the risk of significant loss due to a weather related disaster is reduced.

Key Risks of expanding sales to large chain pet stores include:

1. Pet shop employees might misstate the product benefits and mislead the customer about the product.
2. Veterinarians potentially might be unhappy as they are no longer the sole distributor of Attaboy Insurance and they will miss out on some commissions.

Conclusion

In conclusion, I recommend that the Attaboy Insurance Management Team pursue the accidental death rider and the expansion of sales into large chain pet stores. However, key risks must be taken note of and must be acceptable within Attaboy Insurance Management Team's risk appetite. I do not recommend the separate coverage for high-value dogs or the preferred risk class because the risks of these modifications outweigh the benefits.