

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

12 September 2018 (am)

CA2: Model Documentation, Analysis and Reporting

Paper 1

Time allowed: 3 hours + 15 minutes reading time

INSTRUCTIONS TO THE CANDIDATE

1. You have 15 minutes reading time at the start of the examination in which to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have 3 hours to complete the paper.
2. You must build your model from the beginning and not use an imported e-template.
3. At the end of the examination you have 5 minutes to upload your submission.

Your file names must include your ARN, the name of the document and the paper sat (e.g. 9000000-Summary-Paper1) and each file should contain your ARN as a header or footer.

Please note that the content of this booklet is confidential and students are not to discuss or reveal the contents under any circumstances nor are they to be used in a further attempt at the exam.

If you encounter any issues during the examination please contact Examinations team
T. +44 (0) 1865 268 255

Exam requirements

1. Read the background document, which describes the scenarios that need to be modelled and documented for this project.
2. Construct a spreadsheet model that produces the following calculations and charts. You should ensure that your spreadsheet contains appropriate self-checks and that you have performed and documented robust reasonableness checks at each stage of your calculations.
 - (i) Calculate the income and outgo, under the current situation (Scenario 1), projected for each month over the next two years for Baby Days childcare by:
 - (a) Determining the age progression of children and therefore the number of children in each age range; [5]
 - (b) Calculating Baby Days' income per month from daily fees and other charges (including an allowance for 15 free childcare hours); [4]
 - (c) Calculating costs incurred by Baby Days; and [4]
 - (d) Calculating the net income and the total discounted net income. [3]
 - (ii)
 - (a) Repeat the projections in part (i) for Scenario 2 i.e. based on an increase in the number of free childcare hours from 15 hours to 30 hours for children aged 3 years and over. [2]
 - (b) Determine the daily fees to be charged, assuming the ratio of original fees by age bracket holds, so that the same total discounted net income over the two-year period will be received by the owner of Baby Days. [2]
 - (iii) Construct a suitable chart to compare the net income, per month over time, under scenarios 1 and 2. [2]
 - (iv) Determine the required charges under Scenario 3 i.e. charge for activities as an alternative to increasing the daily fees to maintain the total discounted net income over the two-year period when the free childcare hours for children aged 3 years and over are increased to 30 hours. [5]
 - (v) Construct a suitable chart to compare the daily prices charged in total under the three scenarios, for each age bracket (as defined in scenario 3). For scenario 3, a daily allowance should also be made for the weekly charge for activities. [3]

Note: all scenarios outlined above should be modelled separately within your spreadsheet. The user should not need to change the parameters to see the results.

Marks available for spreadsheet model and checks:

Accurate completion of above modelling steps	[30]
Demonstration of good modelling technique and practice	[7]
Checks (Both automatic and reasonableness)	[8]

[Sub-total 45]

3. Set out an audit trail for your spreadsheet model which includes the following aspects:

- purpose of the model
- data and assumptions used
- methodology, i.e. description of how each calculation stage in the model has been produced
- explanation of the checks performed

You should ensure that your audit trail is suitable for both a senior actuary, who has been asked to approve your work, and a fellow student, who has been asked to peer review and correct your model, or to continue work on it, or to use it again for a similar purpose in the future.

Marks available for audit trail:

Audit approach

Fellow student can review and check methods used in the model	[8]
Senior actuary can scrutinise and understand what has been done	[8]
Written in clear English	[4]
Written in a logical order	[3]

Audit content

All steps clearly explained	[7]
Clear signposting included throughout	[5]
Statement of assumptions made	[5]
All model steps accurately covered	[15]

[Sub-total 55]

[Total 100]

Background

Baby Days is a privately owned company, which provides childcare to children up to the age of 5 years. The Company is owned by one individual, who employs two other members of staff to support.

Under current Government legislation, childcare providers must offer free childcare of 15 hours per week in respect of children aged 3 years and over. The Government is planning to extend the number of free hours childcare from 15 hours to 30 hours per week.

The owner of Baby Days is concerned about the financial impact this will have on their business and has asked your manager for help in understanding how these changes could be mitigated.

Current operation of Baby Days

Children

As at 1 January 2019, Baby Days had the following children enrolled:

Age of child	0	1	2	3	4
Number of children	1	3	2	3	1

All children attend until they reach age 5 years. For the purposes of this analysis you can assume that all the children's birthdays are on the 1st of June, so each child's recorded age will be one year older on 1 June 2019 as compared to the current age profile outlined in the table above.

Children attend the childcare facilities for 10 hours per day and 5 days per week. It is assumed that children attend Baby Days for 4 weeks per month i.e. 20 days per month.

Baby Days' owner has asked that we assume that when a child reaches the age of 5 they leave. We have also been asked to assume that there are no new entrants as the owner of Baby Days is looking to retire soon and does not intend to admit any new children.

Financial Income and Outgo

Income

Baby Days charges parents/guardians a daily fee for childcare. The fee is age dependent. The current advertised daily fees per child are:

For children under 3 years old	\$53 per day
For children 3 years and over	\$50 per day (before adjusting for the free hours – see **)

** Children aged 3 years and over must be provided with some free childcare. To allow for this, Baby Days makes a proportionate reduction to the daily fee to reflect the proportion of hours each week which are required to be provided for free.

If a child is absent due to illness or holiday, the parents/guardians still must pay Baby Days the relevant daily fees due.

Outgo

Baby Days provides food for the children in attendance, at no extra charge to parents/guardians. The cost of food is \$100 per week to Baby Days, irrespective of the number of children attending. Food costs are assumed not to increase with inflation.

Baby Days provides diapers (i.e. nappies), at an additional charge of \$1 per diaper. The actual cost of diapers to Baby Days is \$5 per pack of 20 (price as at 1 January 2019). Baby Days has provided the following table, which gives an estimate of the average number of diapers used per child per day, split by age.

Age of child (years)	0	1	2	3	4
Number of diapers used on average	5	4	3	1	0

Baby Days employs two members of staff who work for 10 hours per day and 5 days per week. As at 1 January 2019 Baby Days pays each staff member a salary of \$7.20 per hour.

It is assumed that the cost of diapers and staff salaries increase with inflation, at the same rate, with the increases coming into effect each 1 April. Based on the central bank's website, current expected inflation is 1.5% p.a. and future cashflows should be discounted assuming an interest rate of 2% p.a.

The owner of Baby Days receives the net income (i.e. income less outgo) each month.

Modelling

Your manager would like you to model projections over the next two years (from 1 January 2019) showing:

- i. the net undiscounted monthly income and outgo; and
 - ii. the discounted monthly net income as at 1 January 2019
- for the following three scenarios.

Scenario 1 – base scenario with 15 hours free childcare

The model should be completed based on providing 15 hours free childcare to children aged 3 years and over.

Scenario 2 – 30 hours free childcare

The model should be completed based on providing 30 hours free childcare to children aged 3 years and over. Based on this projection, you should determine the appropriate daily fee for each age group, assuming the current ratio of advertised daily fees between the two age groups is maintained, such that the total discounted net income received by the owner is the same as that under Scenario 1.

Scenario 3 – 30 hours free childcare but additional charges for activities

Baby Days would like to consider an alternative scenario. Under this scenario, the advertised daily fees remain as per Scenario 1. However in order to generate additional revenue, Baby Days will provide two activities each week for additional charges. The activities will vary each week for the children.

No costs are incurred by Baby Days to provide these activities.

The additional charge per child for each activity will differ for each age, with the charge being higher for younger children. As such, the following multiples are required to the base activity charge for each age range:

Age (years)	1 and under	2	3 and over
Multiple	3	1.5	1

You should assume all children take part in the activities.

The model for this scenario should be completed assuming 30 hours free childcare to children aged 3 years and over. You should determine the base activity charge (i.e. the charge for age 3 and over) such that the net discounted income received by the owner is the same as that under Scenario 1.

Additional requests

Your manager would like you to produce two charts:

- i. To compare the monthly net income over the two-year projection period under Scenario 1 and Scenario 2.
- ii. To illustrate the total fees and charges levied per day in respect of each age range (based on the ranges defined in the table for scenario 3) under all three scenarios.

Your manager is out of the office and cannot be contacted for the next three hours. She would like the above calculations finished and documented in the audit trail ready for her return.

END OF PAPER