# SOCIETY OF ACTUARIES
## Strategic Decision Making Exam

# Exam CFESDM

## MORNING SESSION

**Date:** Thursday, April 26, 2018
**Time:** 8:30 a.m. – 11:45 a.m.

### INSTRUCTIONS TO CANDIDATES

**General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).

   a) The morning session consists of 5 questions numbered 1 through 5.

   b) The afternoon session consists of 4 questions numbered 6 through 9.

   The points for each question are indicated at the beginning of the question. Questions 1 – 9 pertain to the Case Study, which is enclosed inside the front cover of this exam booklet.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

**Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam CFESDM.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

# CASE STUDY INSTRUCTIONS

**The case study will be used as a basis for some examination questions.  Be sure to answer the question asked by referring to the case study.  For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company.  Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit.  Further, if they conflict with the applicable advantages, no credit will be given.**

> ***Question 1 pertains to the Case Study.***
> ***Each question should be answered independently.***

**1.**     (*6 points*)  Information on Darwin Life Insurance Company can be found in Section 7 of the Case Study.

Murphy LLP has material exposure to Darwin corporate debt.  The corporate debt is structured as a five-year zero-coupon bond with a total face amount of $30 million.

At time zero, the market value of the Darwin zero-coupon bond is $82 per face amount of $100.  Assume that the risk-free rate is 3%, and the loss given default is 100%.

(a)     (*2 points*)  Calculate at time zero:

(i)     the market value of the risk-free five-year zero-coupon bond.

(ii)    the market implied credit spread for Darwin corporate debt.

(iii)   the market implied dollar value of the credit risk for the Darwin corporate debt held by Murphy.

Show your work.

Murphy recently implemented new risk limits in which total exposure to a single name cannot exceed $20 million.  Consequently, Murphy is considering entering into a Credit Default Swap (CDS) agreement of $10 million notional.  The agreement would be such that the counterparty would pay Murphy $10 million in the event that Darwin defaults on its corporate debt.

(b)     (*1 point*)  Explain how entering this CDS agreement changes Murphy's risk profile.  Justify your answer.

**1.** **Continued**

Information on Big Ben Bank can be found in Section 6 of the Case Study.

(c) (*2 points*) Describe two reasons why the CDS agreement would have a different impact on Murphy's risk profile if the counterparty were Big Ben Bank.

(d) (*1 point*) Recommend a risk mitigating feature that can be added to the CDS agreement to further improve Murphy's risk profile. Justify your recommendation.

**2.**    (*14 points*)

   (a)    (*1 point*)  Describe one goal and one corresponding challenge of implementing an incentive compensation plan for top-level managers.

   (b)    (*1 point*)  Critique using earnings per share (EPS) as the sole basis for executive compensation.

   (c)    (*2 points*)

      (i)    Describe risk capital for a non-financial company.

      (ii)    Describe how risk capital can be used by a non-financial company.

Information on Blue Jay Air (BJA) can be found in Section 2 of the Case Study.

BJA has identified a plane crash as the only event to be considered for the calculation of its risk capital.

   (d)    (*2 points*)  Identify two of BJA's strategic initiatives that can reduce its risk capital.  Justify your answer.

**2.** **Continued**

BJA's CEO is considering one of the following three actions:

> I.     Retire old planes by eliminating certain routes
> - Reduces required risk capital by 20%
> - No effect on profit margin
>
> II.    Enhance pilot training plan
> - Reduces required risk capital by 10%
> - One-time expense equal to 5% of profit
>
> III.   Offer chartered services to desirable vacation destinations
> - No effect on required risk capital
> - Increases profit margin by 10%

(e)    (*2 points*)  Evaluate each of the actions (I to III) with respect to BJA's strategies, risk appetite including safety, and financial performance.  Justify your answer.

BJA is trying to learn from Volkswagen's recent scandal in order to design an effective executive compensation structure.

(f)    (*2 points*)  Recommend one change to Volkswagen's executive compensation structure that might have prevented the scandal.  Justify your answer.

(g)    (*4 points*)

> (i)    Rank the three actions (I to III) in order of priority based on the evaluation in part (e).  Justify your answer.
>
> (ii)   Recommend performance metrics to be used in BJA's CEO compensation structure that best aligns with the highest priority action identified in part (i).  Justify your answer.

**3.** (*13 points*)  Information on Frenz Corporation can be found in Section 4 of the Case Study.

Frenz is developing a new smartphone app to increase coffee sales. To quantify the expected sales, Frenz's marketing team starts with the actual sales figures from Frenz's last successful marketing campaign.

(a) (*1 point*)

  (i)   Identify a bias caused by the above approach to quantify expected sales. Justify your answer.

  (ii)  Recommend a way to reduce the bias identified in part (i).

Frenz's marketing team categorizes potential customers into the following four groups:

  Group A: Customers loyal to a specific brand (Frenz or another)

  Group B: Adventurers seeking new brands or new ways to access or use products. For example: Frenz's app.

  Group C: Slow responders to any changes. That is, those who are not adventurous, but try a new brand or a new technology based on recommendations or new trends.

  Group D: Those who are indifferent and consume products based solely on convenience such as a store's location.

(b) (*2 points*)

  (i)   Explain the spotlight effect.

  (ii)  Identify which one of the four groups above is most likely to be influenced by the spotlight effect. Justify your answer.

(c) (*2 points*)  Describe two features to include in the smartphone app design to exploit the spotlight effect. Justify your answer.

**3.** **Continued**

Frenz is considering a new app feature to enable cross-selling opportunities.  Customers are presented with coffee-related products, such as coffee makers, with the option to purchase them.

(d)   (*4 points*)

(i)   Assess whether or not the cross-selling feature will appeal to each of the four identified groups.  Justify your answer.

(ii)   Describe how each demand risk, as described in Section 4 Exhibit 2 of the Case Study, is impacted for each customer group.

(e)   (*4 points*)  Recommend three marketing tactics that could be used to announce this new app feature.  Justify your answer using choice architecture principles.

**4.** (*13 points*)  Information on Blue Jay Air (BJA) can be found in Section 2 of the Case Study.

Recent market analysis has shown a drop in the public's opinion of BJA.  Customer surveys indicate that major repairs to BJA planes causing long passenger delays are the primary cause of the change in opinion.

To better predict which aircraft will need lengthy repairs prior to boarding, BJA has employed two mechanics to assess the likelihood of lengthy repairs causing passenger delays for each of its planes.

Mechanics A and B each performed a check on four planes with check engine alerts and assessed the probability that a lengthy repair would be needed.

| Plane | Probability for A | Probability for B | Did delay actually occur? |
|-------|-------------------|-------------------|---------------------------|
| 1 | 0.5 | 0.8 | Yes |
| 2 | 0.7 | 0.8 | Yes |
| 3 | 0.1 | 0.6 | No |
| 4 | 0.9 | 0.7 | Yes |

(a)    (*2 points*)

   (i)    Critique BJA's reliance on its subject matter expert-based scoring method for risk assessment.

   (ii)   Determine which mechanic's estimations (A or B) require more calibration based on their Brier score.  Show your work.

**4.** **Continued**

A proposed Monte Carlo model uses historical industry average repair data to derive a number of general distributions of time and cost to repair a variety of issues – one for each cockpit warning light that turns on.  Below is an example distribution of repair time and cost when the 'check engine' light is on:

| Issue Severity (Determined by mechanic) | Example Issue Description | Distribution of repair time (hours) | Distribution of cost per hour ($) |
|---|---|---|---|
| Low | Loose fuel cap | 0.5 | $0 |
| Medium | Replacement needed for peripheral component | U(0.5,2.5) | U(20,100) |
| High | Major repair to engine needed | N(100,5) | N(10000,3000) |

U(X,Y) represents uniform distribution with lower bound X and upper bound Y.
$N(\mu,\sigma)$ represents normal distribution with mean $\mu$ and standard deviation $\sigma$.

To test the two-parameter Monte Carlo scenario, you are given two random uniform variable results to apply to the above distribution for a medium severity issue: 0.975 for repair time and 0.340 for cost per hour.

(b)    (*2 points*)

    (i)    Describe one pro and one con of using Monte Carlo simulations for risk modeling.

    (ii)    Determine the cost of repair based on information provided above.  Show your work.

You have decided to build a structural model that would further increase the quality of the repair estimates.

(c)    (*4 points*)

    (i)    Compare and contrast structural models versus parametric models.

    (ii)    Identify three specific characteristics of BJA that should be considered in the structural model.  Justify your answer.

    (iii)    Recommend a method to validate the structural model.  Justify your answer.

*Question 4 is continued on next page.*

**4. Continued**

BJA management wants to avoid departure and arrival delays.

(d)     (*3 points*)

      (i)     Describe characteristics of an appropriate risk appetite statement BJA could use concerning delays.

      (ii)    Draft an appropriate risk appetite statement concerning delays.

      (iii)   Recommend an appropriate risk appetite upper trigger for the statement provided in part (ii).  Justify your answer.

Senior management is deciding between two strategies to implement when the risk profile approaches the upper trigger:

- Strategy A:  Blue Jay Air will refurbish a significant portion of the fleet.
- Strategy B:  Blue Jay Air will retire routes that are greater causes of delay.

(e)     (*2 points*)  Compare and contrast senior management's strategies.

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**5.** (*14 points*)  There are three types of conflict that can occur within organizations:

> C1:  Personal conflict
> C2:  Substantive conflict
> C3:  Procedural conflict

(a)  (*3 points*)

  (i)  Define each type of conflict (C1-C3).

  (ii)  Determine whether each type of conflict (C1-C3) is Functional or Dysfunctional.  Justify your response.

  (iii)  Identify which type of conflict (C1-C3) corresponds to each of the curves (X, Y, and Z) given in the graph below.  Justify your response.
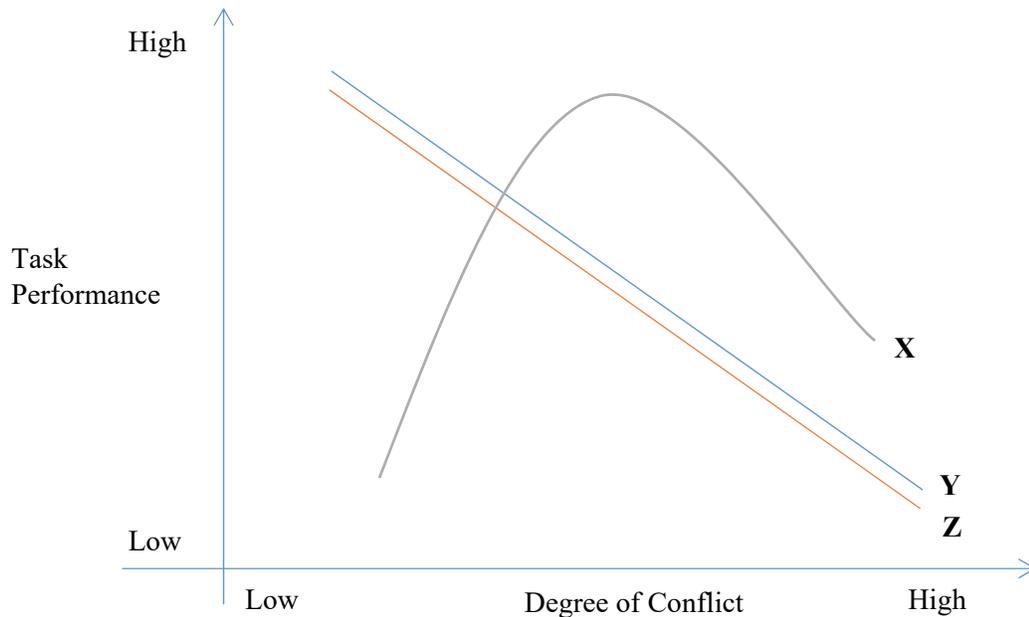
**5.** **Continued**

You are given that the five bases of individual power are:

       I.     Legitimate Power
       II.    Reward Power
       III.   Coercive Power
       IV.   Expert Power
       V.    Referent Power

(b)    (*2 points*)

      (i)     Evaluate whether each type of conflict (C1-C3) is demonstrated within Volkswagen's culture.

      (ii)    Identify two bases of individual power (I-V) demonstrated by Volkswagen's leadership.

      Justify your answers based on the "*Hoaxwagen*" reading.
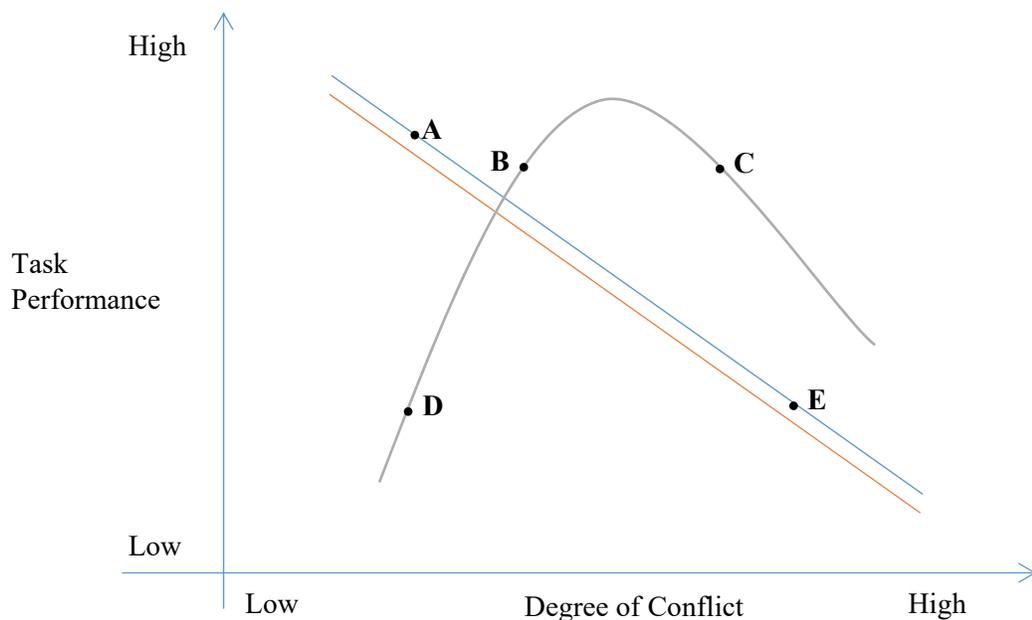


(c)    (*2 points*)  Identify which point (A-E) on the graph above would best represent Volkswagen's culture.  Justify your answer based on the "*Hoaxwagen*" reading.

*Question 5 is continued on the next page.*

**5.**     **Continued**

Information on Blue Jay Tire Company (BJT) can be found in Section 3 of the Case Study.

(d)     (*1 point*)  Identify which base of individual power (I-V) Jack Tavares exhibits in relation to the Production Expansion Committee.  Justify your response.

The Production Expansion Committee has successfully purchased the third manufacturing plant in Mobile, Alabama with the goal of reaching the same production target level as the two previously purchased manufacturing plants within a two year period.  Given the expected limitation on production of the third plant during this refitting period, senior management has decided to increase the production level for the first and second plants to reach the overall final working capacity assuming no output from the third plant.  In order to reach the final working capacity, the first two plants would need to be operating above normal manufacturing capacity during this period.  This has created conflict between management of BJT and the workers of the original two plants as their compensation is not being adjusted to reflect these management decisions.  BJT has selected Jack Tavares as the key executive figure to help mediate the conflict.

There are four possible conflict outcomes:
    O1.    Lose-Lose
    O2.    Lose-Win
    O3.    Compromise
    O4.    Win-Win

(e)     (*4 points*)  For each of the four possible conflict outcomes (O1 to O4):

    (i)     Describe an approach that Jack Tavares could take that would likely result in the respective conflict outcome.  Justify your response.

    (ii)    Identify the base of individual power (I -V) demonstrated by Jack Tavares under each approach described in part (i).

Senior management has expressed concerns over not meeting the expected return on the third manufacturing plant.  They are concerned that additional costs may be incurred and would prefer to not deviate from the pre-established budget during this refitting period.  In light of this, the remaining non-union workers are considering joining the union to protect their rights.

(f)     (*2 points*)  Recommend a strategy using integrative bargaining tactics that senior management can use to maximize the likelihood of a Win-Win conflict outcome.  Justify your response.

**\*\*END OF EXAMINATION\*\***
**Morning Session**

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