Complete the Excel sheets labelled **INFORMATION DO NOT change the format in the Excel Sheet.**

## M&M Inc

The M&M Inc is a Caribbean-based car manufacturer, located in Trinidad and Tobago. The company has been exploring the prospect of introducing a new hybrid car (which uses gas & electricity). Top management of the company decided that the introduction of the car will materialise only if there is an 85% chance of a positive net present value, over the next 10 years. There is high start-up cost, estimated between US$300M and US$900M, and follows **Uniform** probability distribution.

Forecast production is 100,000 hybrid cars in the first year. But there is some uncertainty in demand during the first year, and management has decided to take 2 approaches to model demand, given below:

1. demand is normally distributed with mean 95,000 and standard deviation 7,000.
2. demand follows a discrete distribution, as given in Table 1

**Table 1: Demand for hybrid cars**

|  |  |
| --- | --- |
| **Demand (D)** | **P(D)** |
| 92000 | 0.08 |
| 93000 | 0.10 |
| 94000 | 0.18 |
| 95000 | 0.15 |
| 96000 | 0.25 |
| 97000 | 0.15 |
| 98000 | 0.09 |

**Other Details**

Any year in which

* demand exceeds production, production will be **increased** by 5% in the following year.
* production exceeds demand, production will be **decreased** by 5% in the following year and the surplus (cars) will be sold to rental car companies at a 20% discount.
* **After year 1**, demand will be modelled, using two approaches:
  1. as a normally distributed random variable with a mean equal to the **actual demand** in the previous year and standard deviation of 1,000.
  2. as a Discrete distributed random variable (see Table 1)
* In year 1, the sales price for the hybrid car is expected to be US$35,000, and the variable cost per car is expected to be US$26,000.
* Both the **selling price** and **variable cos**t are expected to increase **each year** at the rate of inflation, which is assumed to be between 3% and 6%.
* M&M uses a discount rate of 9% to discount future cash flows.

**Required**

1. Create a spreadsheet model for this scenario, for each of the 2 demand distributions – Normal and Discrete **(2 + 2 = 4 Marks)**
2. Replicate **each** of the models 500 times, tracking **Total NPV** (1-way Data Table)**.**

# (1 + 1 = 2 Marks)

1. Based on the replications for **both cases – when demand is normal and when demand is discrete**(done for (b)), calculate the minimum, average, and maximum total NPV M&M can expect if the company decides to produce this car. (**HINT**: might prove useful if the NPV( ) function is used to discount the profits M&M would earn each year.) **(2 Marks)**
2. For both models, calculate the probability of M&M earning a positive NPV over the next 10 years? **(2 Marks)**
3. Should they produce this car? Why? Why not? **(1 Mark)**
4. Conduct sensitivity analysis if there is variation in the standard deviation, **when demand is normally distributed**. Do this by generating a two-way Data Table for 500 replications of the when standard deviation ranges from 5,000 to 10,000, in increments of 1000.

**(2 Marks)**

1. From the two-way Data Table done in part (f), generate an **automatic highlight** the standard deviation that gives the **maximum total NPV** (Note: this could result in a change of the value highlighted when the simulation is refreshed) **(2 Marks)**

***HINTS:***

1. Among pieces of information given: Production adjustment, Inflation rate, Discount rate & Surplus discount
2. All that is required can be done on the same sheet