**Chapter 1 Exercises**

1. Name entities, attributes, activities, events, and state variables for the following systems:
2. A cafeteria

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| Entities | Attributes | Activities | Events | State Variables |
| Diners. | Size of appetite.    Food preference. | Selecting food.  Paying for food. | Coming to the service line.  Going from service food. | Number of diners.  Number of servers. |

1. A grocery store

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| Entities | Attributes | Activities | Events | State Variables |
| Shoppers/Buyers. | Groceries list. | Picking items at aisle.  Checkout. | Arrival at checkout counters.  Departure from  checkout counter. | Number of shoppers in queue.  Number of checkout lanes available. |

1. A laundromat

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| Entities | Attributes | Activities | Events | State Variables |
| Washing machine. | Breakdown rate. | Repairing a machine.  Machine running. | Occurrence of breakdown.  Completion of service. | Number of machines running.  Number of machine that broke. |

1. A fast-food restaurant

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| Entities | Attributes | Activities | Events | State Variables |
| Customers. | Size of order | Placing the order. | Arrival at the counter.  Completion of purchase. | Number of customers waiting.  Number of windows operating. |

1. A hospital emergency room

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| Entities | Attributes | Activities | Events | State Variables |
| Patients. | Emergency level/ Priority level. | Providing treatment required. | Arrival of the patient.  Departure of the patient.  . | Number of patients waiting.  Number of physicians working. |

1. A taxicab company with 10 taxis

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| Entities | Attributes | Activities | Events | State Variables |
| Patients. | Fares. | Origination.  Destination. | Fare for pickup.  Fare for drop-off. | Number of available taxis.  Number of waiting pickups/ drop-offs. |

1. An automobile assembly line

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| Entities | Attributes | Activities | Events | State Variables |
| Automobile assemblers | Speed.  Breakdown rate. | Welding. | Breakdown. | Availability of assemblers. |

1. A simulation of a major traffic intersection is to be conducted, with the objective of improving the current traffic flow. Provide only two iterations, not three, and in the second iteration provide a more specific statement of “improving the current traffic flow”.

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| Iteration | Process description | Steps |
| 1 | Vehicles arriving at the intersection are controlled by a traffic light. The  vehicles may go straight, turn left, or turn right. Right on red is allowed after full stop provided no pedestrians  are crossing and no vehicle is approaching the intersection. | How should the traffic light be sequenced?  Criterion for evaluating effectiveness:  average delay/arrival time of cars.  Resources required:   * 2 people for two weeks for data collection. * 1 person for 4 days for data analysis. * 1 person for 4 days for model building. * 1 person for 2 days for running the model. * 1 person for 3 days for implementation. |
| 2 | Trucks arrive at the intersection. Vehicles break down in the intersection making one lane impassable. Accidents occur blocking traffic for varying amounts of time. | How should the traffic light be sequenced?  Should the road be  widened to 4 lanes?  Method of evaluating effectiveness:  average delay/arrival time of all vehicles.  Resources required:   * 2 people for two weeks for data collection * 1 person for 4 days for data analysis * 1 person for 4 days for model building. * 1 person for 2 days for running the model. * 1 person for 3days for implementation. |

1. What are the events and activities associated with the use of your checkbook?

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| Events | Activities |
| Deposit.  Withdrawal. | Writing a check.  Cashing a check.  Making a deposit.  Verifying the account balance.  Reconciling the checkbook with the bank statement. |