A. Problem 11.2

11.2 You have a number of trucks with which to deliver a set of packages. Each package starts at some location on a grid map, and has a destination somewhere else. Each truck is directly controlled by moving forward and turning. Construct a hierarchy of high-level actions for this problem. What knowledge about the solution does your hierarchy encode?

Use nagivate (T, [x, y]) to bring the truck to the coordinates [x, y], and then use deliver (T, P) to deliver. Then the fluent at (O, [x, y]) for trucks and packages o records their current position [x, y], the predict destination (P, [x ′, y ′]) gives the package's destination from a higher level, the hierarchy indicates that the planner only needs to select which trucks to transport which packages in what order, and the trucks should navigate according to the destination.

B. Problem 11.6

11.6 In Figure 11.2 we showed how to describe actions in a scheduling problem by using separate fields for DURATION, USE, and CONSUME. Now suppose we wanted to combine scheduling with nondeterministic planning, which requires nondeterministic and conditional effects. Consider each of the three fields and explain if they should remain separate fields, or if they should become effects of the action. Give an example for each of the three.

The natural uncertainty of duration, use, and consumption generally represents the interval of each possible value, not a single value. The algorithms of processing capacity can be modified relatively easily to manage the interval of processing capacity. Therefore, if the agent starts with 10 screws and the first operation in the plan consumes 2-4 screws, the second operation requiring 5 screws is still executable. However, when it comes to conditional effects, fields must be treated differently“ The use field refers to the constraints that remain during the operation rather than after the operation is completed. Therefore, it must remain a separate field.

C. 12.3

12.3 Develop a representational system for reasoning about windows in a window-based computer interface. In particular, your representation should be able to describe:

- The state of a window: minimized, displayed, or nonexistent.
- Which window (if any) is the active window.
- The position of every window at a given time.
- The order (front to back) of overlapping windows.
- The actions of creating, destroying, resizing, and moving windows; changing the state of a window; and bringing a window to the front. Treat these actions as atomic; that is, do not deal with the issue of relating them to mouse actions. Give axioms describing the effects of actions on fluents. You may use either event or situation calculus.

Assume an ontology containing *situations, actions, integers* (for x and y coordinates) and *windows*. Define a language over this ontology; that is, a list of constants, function symbols, and predicates with an English description of each. If you need to add more categories to the ontology (e.g., pixels), you may do so, but be sure to specify these in your write-up. You may (and should) use symbols defined in the text, but be sure to list these explicitly.

A language may contain:

Temporary predicates:

Result(a, s)

Arithmetic:x+y,x>y,etc

Window State:

Display(window,situation),Active(window,situation),Minimized(window, situation)

Window Position:

Right(w,s),Left(w,s),Top(w,s),Bottom(w,s)

Window Ordor:

inFrontOf(w1,w2,s)

Actions:

Visible(w), Destroy(w), Front(w), Move(w,x,y), Resize(w,l,r,u,d)

D. Problem 13.7

13.7 Consider the set of all possible five-card poker hands dealt fairly from a standard deck of fifty-two cards.

a. How many atomic events are there in the joint probability distribution (i.e., how many five-card hands are there)?

b. What is the probability of each atomic event?

c. What is the probability of being dealt a royal straight flush? Four of a kind?

(a)There are C(52,5)=2598960 possible.

(b)Because each of these is equally, So each occurs with probability 1/2598960

(c)P(four hands are royal straight flushes)=4/2598960=1/649740, P(four of a knd)= (13*48)/2,598,960 =1/4,165.

E. Problem 13.8

13.8 Given the full joint distribution shown in Figure 13.3, calculate the following:

a. $\mathbf{P}(toothache)$.
b. $\mathbf{P}(Cavity)$.
c. $\mathbf{P}(Toothache \mid cavity)$.
d. $\mathbf{P}(Cavity \mid toothache \vee catch)$.

a. P(toothache) = 0.108 + 0.012 + 0.016 + 0.064 = 0.2
b. P(Cavity) = ⟨0.2, 0.8⟩ .
c. P(Toothache |cavity) = ⟨(.108 + .012)/0.2, (0.072 + 0.008)/0.2⟩ = ⟨0.6, 0.4⟩
d. P(Cavity|toothache∨catch) =⟨(0.108 + 0.012 + 0.072)/0.416, (0.016 + 0.064 + 0.144)/0.416⟩ =⟨0.4615, 0.5384⟩

F. Problem 13.13

13.13 Consider two medical tests, A and B, for a virus. Test A is 95% effective at recognizing the virus when it is present, but has a 10% false positive rate (indicating that the virus is present, when it is not). Test B is 90% effective at recognizing the virus, but has a 5% false positive rate. The two tests use independent methods of identifying the virus. The virus is carried by 1% of all people. Say that a person is tested for the virus using only one of the tests, and that test comes back positive for carrying the virus. Which test returning positive is more indicative of someone really carrying the virus? Justify your answer mathematically.

V: the patient has the virus

A: medical test A return positive

B: medical test B return positive

P(V) = 0.01

P(A|V) = 0.95

P(A|¬V) = 0.10

P(B|V) = 0.90

P(B|¬V) = 0.05

Because P（V | A）=0.0876，P（V | B）=0.1538，so B is more indicative.

For the questions is asking which test has the highest posterior odds ratio

P(V |A)/P(¬V |A), For the Bayes theorem, ordering is independent of the P(v), so we just need to compare the ratios P(A|V)/P(A|¬V) = 9.5 and P(B|V)/P(V |¬V) = 18