Exam exercises
There are some more exercises here than will be in the real exam.

No aids You can answer in either English or Swedish

1) All red flowers are beautiful.
   Flowers are either red, yellow or blue.
   Peter only likes beautiful things.
   No blue things are beautiful.
   Peter doesn’t like yellow things.

   a) Translate the sentences above to predicate logic. Use the predicates: beautiful, flower, red, yellow, blue, and peterLikes. As everything is a thing we don’t need a predicate for that.

   b) Transform the result from a) to clauses.

   c) Show with resolution that if Peter likes a flower, then it is red. (7)

2) Define a lisp function, foo, which has two lists as arguments; the first one is twice as long as the second. Foo shall return a list with two elements from the first argument, one from the second, two from the first and so on.

   (foo '(a b c d e f) '(x y z)) = (a b c d y e f z) (5)

3) The numbers in the graph below are the real distances between the nodes. The estimated distances to the goal node, G, are the following:

   A: 18   B: 13   C: 8   D:18   E: 5   F: 6

   A is the start node.

   ![Graph with distances]

   Do a search with algorithm A. You can either show the succesive open and closed list marked with the merit values for the nodes, or you can show the search tree, also with the values. Mark also in the tree the order in which the nodes are expanded. Can we be certain that we have found the best path? Motivate! (7)
4) Suppose you get lost when you are touring in the vast forests of Siberia, and you find yourself in an unknown city. You know there are four cities in the area, Omsk, Tomsk, Komsomolsk and Smolensk. From the look of the City Hall you estimate the probability that you are in Omsk to 20%, in Tomsk to 40%, in Komsomolsk to 10% and in Smolensk to 30%. You then ask a woman a question and she answers you in Esperanto. You know that 50% of the inhabitants of Omsk speak Esperanto, 20% in Tomsk, 40% in Komsomolsk and 10% in Smolensk. Use Bayes’ rule to calculate the probability that you are in Tomsk.

5) We want to learn to recognise some kind of book. Demonstrate how candidate elimination works, and show the successive values of G and S, if the domain has the following properties and values:

The book can be a thriller, science fiction or poetry,
it can be bound or unbound,
it can be in German, French or Dutch,
it can be cheap or expensive,
and it can be white, red or yellow.

The training examples are:

Positive: (t b g e r)
Negative: (s u g c w)
Positive: (t u g e r)
Negative: (t b f e y)
Positive: (t b g e y)
Negative: (p u g e r)
Positive: (t b g c r)

6) In the book seven levels of analysis for natural language are mentioned. Which are they and what do they do?

7) Describe the following AI-concepts (without going into details):

a) Closed world assumption
b) Abduction, induction and deduction
c) Bayesian networks
8) Perform min-max search with $\alpha$–$\beta$ pruning in the tree below. Enter values at the nodes as soon as you know something. Show the branches which are cut, and the nodes in the bottom layer which are not evaluated. The top node is a max node.

9) What is nonmonotonicity, and how is it dealt with in truth maintenance systems, and in systems with add, delete and precondition lists?