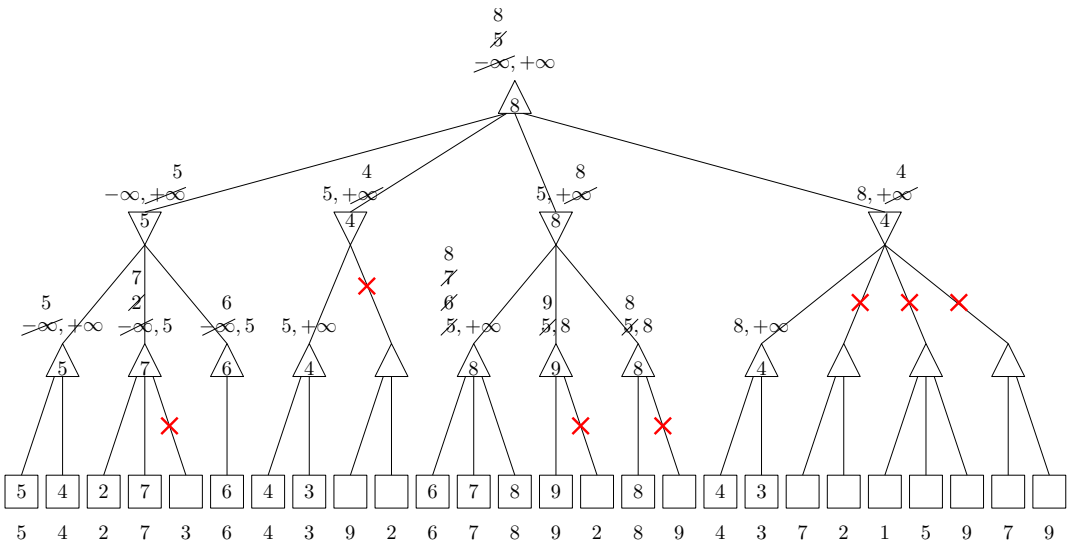
Answers for Practice Final Examination

1. Consider the following game tree, use *alpha-beta pruning* algorithm to cross out unnecessary subtrees. Assume that the tree is evaluated by backtracking algorithm from left to right.



2. *Probability: Independence of events*

   (a)

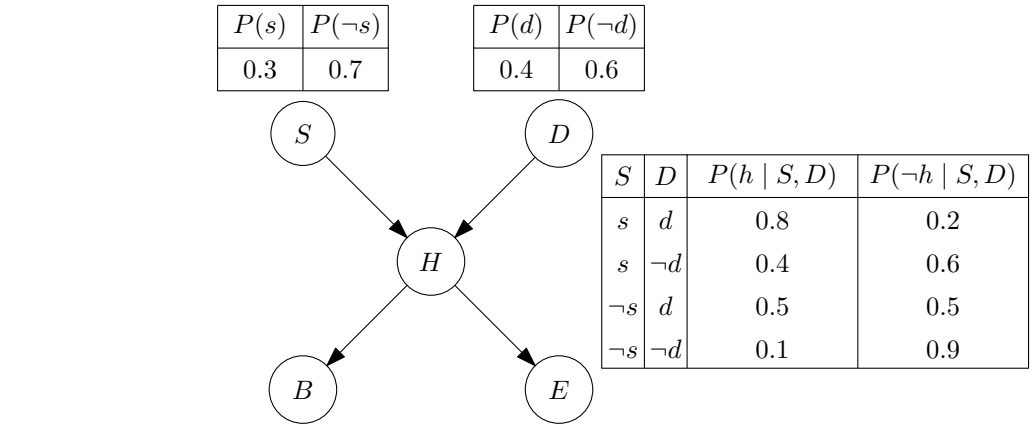
   i. 0.85
   ii. 0.475
   iii. 0.316
   iv. 0.375
   v. 0.15
   vi. They are *not* independent because $P(Fever)P(Cold) \neq P(Fever \wedge Cold)$

   (b)

   i. 48
   ii. 16
   iii. 11

3. *Bayesian Networks*

   (a)



$P(s)$	$P(\neg s)$
0.3	0.7

$P(d)$	$P(\neg d)$
0.4	0.6

S	D	$P(h \mid S, D)$	$P(\neg h \mid S, D)$
s	d	0.8	0.2
s	$\neg d$	0.4	0.6
$\neg s$	d	0.5	0.5
$\neg s$	$\neg d$	0.1	0.9

H	$P(b \mid H)$	$P(\neg b \mid H)$
h	0.7	0.3
$\neg h$	0.1	0.9

H	$P(e \mid H)$	$P(\neg e \mid H)$
h	0.8	0.2
$\neg h$	0.1	0.9

(b) 0.0288

(c) 0.471

4. *First-Order Logic*

(a) $Dog(Pluto)$

(b) $\forall x \forall y \Big(\Big(Dog(x) \wedge Larger(x, Pluto) \wedge Dog(y) \wedge Larger(y, Pluto) \Big) \rightarrow \Big(x = y \Big) \Big)$

(c) $\forall x \Big(\neg \Big(Dog(x) \wedge Larger(x, Pluto) \Big) \Big)$

(d) There is exectly one dog that is larger than Pluto.

(e) There are at least two dogs that are larger than Pluto.

5. *Prolog*

(a) Write Prolog queries

i. `?- movie(americanBeauty,Y).`

ii. `?- movie(M, Y), Y < 2000.`

iii. `?- actor(M, A, _), actor(N, A, _), M \== N.`

iv. `?- director(M, D), actress(M, A, _), actress(M, B, _), A \== B.`

v. `?- actor(_, A, _), director(_, A, _).`

(b) Write Prolog rules

i. `released_since(M, Y) :- movie(M, Z), Z >= Y.`

ii. `released_between(M, Y1, Y2) :- movie(M, Z), Z >= Y1, Z =< Y2.`

iii. `same_year_as(M1, M2) :- movie(M1, Y), movie(M2, Y).`

iv. `newer(M1, M2) :- movie(M1, Y), movie(M2, Z), Y > Z.`

v.
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cast_member(A, M) :- actor(M, A, _).
cast_member(A, M) :- actress(M, A, _).
```

vi.
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directed_by(X, Y) :- actor(M, X, _), director(M, Y).
directed_by(X, Y) :- actress(M, X, _), director(M, Y).
```
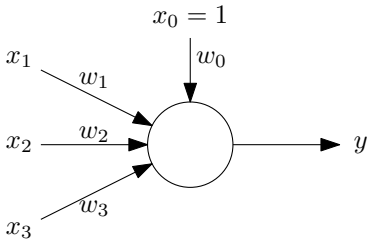

6. *Machine Learning*

   (a) Class 0



   (b)

7. *Machine Learning*

   (a) $y = \text{sgn}(-0.5 + (1.5)(1) + (2.0)(-2)) = 0$

   (b) *(Errata) Use the following figure for the dataset*