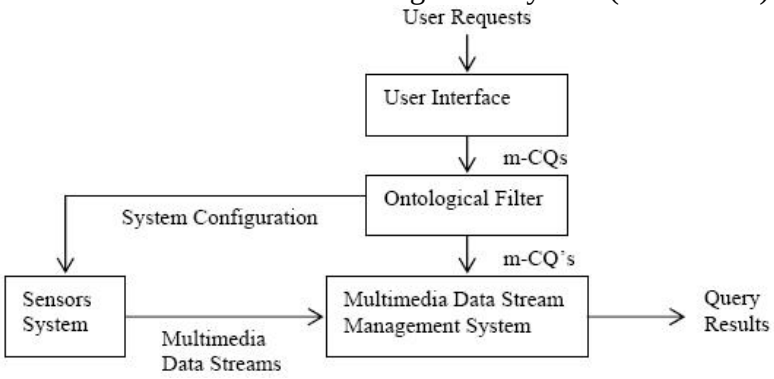
CS2310 Midterm Exam (Oct 16, Thursday, 4pm to 4:45pm)

Name: _____ SSN: _____

(1) A Multimedia Data Stream Management System (MMDSMS) is illustrated by Figure 1.



(1a) (@1 point) Explain how the system will behave when certain sensors are not working properly.

(Hint: To answer these questions, the best way is to draw some arrows on Figure 1 and also explain in words how the system will behave.)

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ANS: (1a) The user request is transformed by the Ontological
ANS: Filter into a modified query so that the malfunctioning
ANS: sensors are not referenced by the modified query. The
ANS: situation is illustrated by Figure 2.
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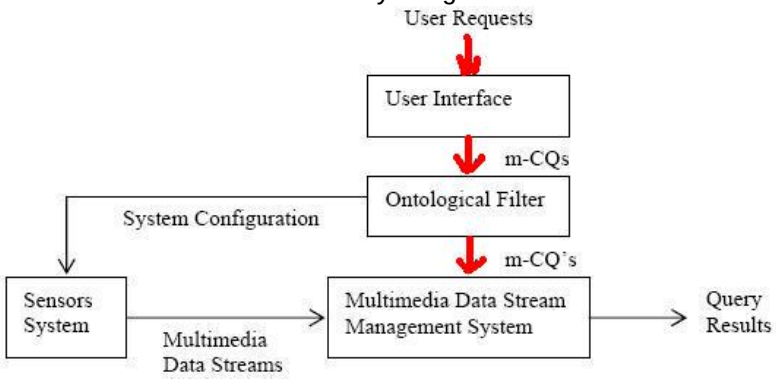
ANS:



(1b) (@1 point) Explain how the system will behave when the user query will not make use of certain sensors.

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ANS: (1b) The Ontological Filter will
ANS: send system configuration parameters to the sensors
ANS: system to request these sensors be turned off.
ANS: The situation is illustrated by Figure 3.
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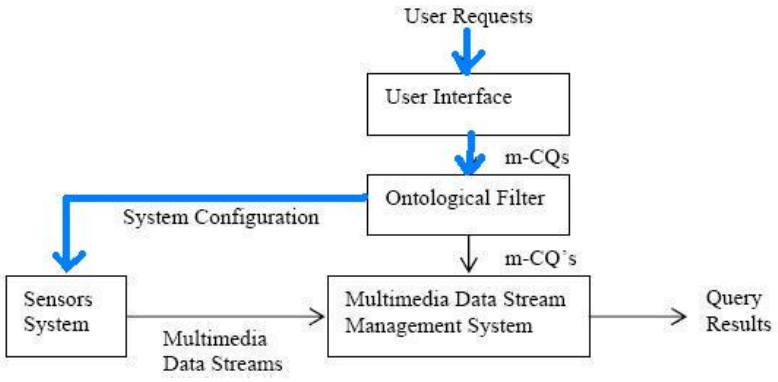
ANS:



(2) A slow intelligence abstract machine is used to tackle the 8-puzzle problem. The following cycle is defined:

cycle 1: [guard1,1] P0 -enum< P1 >elim- P2

The initial problem set P0 is {<123,804,765>} and The goal configuration is also <123,804,765>.

(2a) (@2 points) Compute P1 and P2 at the end of the first cycle.

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ANS: (2a)
ANS: P1 = {<103,824,765>, <123,084,765>, <123,840,765>, <123,864,705>}
ANS: P2 is empty set
ANS: To TA, each correct answer is 1 POINT.
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(2b) (@2 points) If cycle 1 is to be repeated, what should be the new initial problem set?

ANS: (2b) P1.

(3) (@2 point) Will the machine specified in problem (2) ever halt?

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ANS: (3) Yes it will halt after 2 cycles.
ANS: To TA, if student only answers "yes" but does
ANS: not specify after how many cycles, 1 POINT.
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(4) (@3 points) According to Christopher Alexander, a pattern is a three-part rule r(X, P, S), which expresses a relation r between a certain context X, a problem P, and a solution S. Describe the patterns for finding an apartment, and translate the patterns into IC cards. (Hint: you should have at least three patterns, and each pattern corresponds to at least one IC card. But if you run out of time, at least provide one pattern and one IC card.)

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ANS: (4) To TA, each pattern and IC card pair is worth 0.5 POINT respectively.
ANS: (1) Pattern: FindingApartment(P, X, S)
ANS:     Problem: finding an apartment
ANS:     Context: Apartment must be close to campus
ANS:     Solution: Pick date and place
ANS:     Color:  Purple (complex)
ANS:     My Task: Pick date and place to look for apartment
ANS:     Name of Other IC: PickDate, PickPlace
ANS:     Message to Other IC: PickDate(constraints), PickPlace(constraints)
ANS:     Other IC's Task:    PickDate, PickPlace
ANS:
ANS: (2) Pattern: PickDate(P, X, S)
ANS:     Problem: Pick a date for inspecting the apartment
ANS:     Context: must be weekend and before midterm
ANS:     Solution: send messages to apartment owners
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ANS:     IC Name:  Pick_Date
ANS:     Description:  Pick a Date for apartment inspection
ANS:     Color:  Yellow      (Myself with Interaction)
ANS:     My Task:  Decide on Date
ANS:     Name of Other IC: Apartment owners
ANS:     Message to Other IC: Choose preferred dates in weekend and before midterm
ANS:     Other IC's Task: Choose dates.
ANS:
ANS: (3) Pattern: PickPlace(P, X, S)
ANS:     Problem: Pick a place for the inspection
ANS:     Context: must be within walking distance from school
ANS:     Solution: send messages to apartment owners
ANS:     IC Name:      Pick_Place
ANS:     Description:  Pick a Place for the inspection
ANS:     Color:        Yellow      (Myself with Interaction)
ANS:     My Task:      Decide on Place
ANS:     Name of Other IC: Apartment owners
ANS:     Message to Other IC: Provide available places within 1 mile from school
ANS:     Other IC's Task: Provide available places.
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(5) (@2 points) Does multimedia functional dependency imply functional dependency? That is, if $X_{g1(t1)}$ -> $Y_{g2(t2)}$ then X -> Y. Explain why.

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ANS: (5)
ANS: no.
ANS: Because MFD is less strict than normal functional dependencies.
ANS: To TA, each answer is 1 POINT.
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(6) A multimedia database for dogs is R1(ID, NAME, PHOTO, TYPE) where ID is the primary key. This database R1 can be searched by TYPE. The SQL query Q1 is:

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Select *
from R1
where TYPE == "pug"
```

A new multimedia dependency is introduced: $PHOTO_{g1(t1)}$->$TYPE_{g2(t2)}$ so that we can now search by matching photos of different dogs.

(6a) (@2 points) Describe the transformation algorithm in pseudo-code and show how the database R1 can be systematically transformed into a normalized database R2.

(6b) (@2 points) Describe the transformation algorithm in pseudo-code and show how the query Q1 can be systematically transformed into a new query Q2.

(project suggestion: If you can describe the transformation algorithms formally and also implement them with some experimental results, it will make a very interesting term project.)

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ANS: (6a) apply normalization technique

ANS: R1 has a set of functional dependencies F on the attributes of R,
ANS: F = { ID->Name, PHOTOg1(t1)->TYPEg2(t2) }
ANS: 1. Find a minimal cover G for F
ANS:     {ID, Name}, {ID, PHOTO, TYPE}
ANS: 2. Create a table for each item in the G. So we have two tables:
ANS:     R1a:ID+Name
ANS:     R1b:ID+PHOTO+TYPE
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ANS: (6b) Since we have a MFD from PHOTO to TYPE, we can replace
ANS: a clause involving TYPE by a clause involving PHOTO, and also
ANS: replacing the equality == by similarity =\\=, and literals by
ANS: photos.  THus the query Q2 is:
ANS: Select *
ANS: from R2
ANS: where PHOTO =\\= pug's photo
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(7) (@3 points) After the midterm, install the zipped SIS software on your notebook. Then on Tuesday next week show TA how to run the SIS server, then the Universal Interface prjRemote, finally to send messages from the Universal Interface to an application program, and to display the results on the Universal Interface. The application could be something you found from the downloaded package.