Question 1 [10 Marks – 1 Mark each]

Select the best answer from the given options. Fill in the answer on the answer sheet given on the last page. Answers not filled in the answer sheet will NOT be graded

1. What is knowledge?
   a. Data that has been given meaning through relational connection.
   b. All beliefs.
   c. A subset of all understandable things.
   d. A subset of all true beliefs.
   e. None of the above

2. What is one of the main purposes of OWL?
   a. Define complex logical constraints
   b. Exchange information
   c. Query, filter and aggregate data
   d. All of the above (a-c)
   e. None of the above (a-c)

3. Reusing existing ontologies is an important aspect in ontology engineering. Why?
   a. To save costs.
   b. To reuse ontologies that have been validated by their application.
   c. To apply tools that are applied for other existing ontologies also for our own ontology.
   d. All of the above (a-c)
   e. None of the above (a-c)

4. What should be considered first when a vocabulary is needed?
   a. Define a new vocabulary
   b. Reuse existing vocabularies
   c. Use any familiar vocabulary and reinterpret their meaning
   d. All of the above (a-c)
   e. None of the above (a-c)

5. What is the range of an *Object Property* in OWL?
   a. a Class
   b. a Datatype
   c. a Property
   d. an Individual
   e. Any of the above

6. How can different knowledge bases be interconnected?
   a. by defining identical individuals and equivalent classes
   b. by linking to a common upper ontology
   c. by typed links between individuals of the knowledge bases
   d. All a, b and c
   e. Only a and b

7. What kind of knowledge can be expressed with RDF Schema?
   a. class and property hierarchies
   b. domain and range of properties
   c. disjointness of classes and properties
   d. All of a, b and c
   e. Only a and c

8. What are reasons to develop a vocabulary or an ontology?
   a. To develop trust
   b. To represent knowledge
   c. To share common understanding of the structure of information
   d. All a, b and c
   e. Only b and c

9. What does it mean, an ontology needs to be *explicit*?

a. The meaning of all concepts must be defined
b. The ontology is an abstract model
c. The ontology must be represented in a machine understandable format
d. There needs to be consensus about the meaning of the terms in the ontology among its users
e. None of the above

10. What does it mean, an ontology needs to be *a conceptualization*?
a. The meaning of all concepts must be defined
b. The ontology is an abstract model
c. The ontology must be represented in a machine understandable format
d. There needs to be consensus about the meaning of the terms in the ontology among its users
e. None of the above

Consider a graph containing the following triples:

```
@prefix dbo: <http://dbpedia.org/ontology/> .
@prefix dbr: <http://dbpedia.org/resource/> .

dbr:Captain_America:_Civil_War a dbo:Film ;
  dbo:producer dbr:Kevin_Feige ;
  dbo:starring dbr:Daniel_Brühl ,
    dbr:Robert_Downey_Jr. ,
    dbr:Scarlett_Johansson ;
  dbo:distributor dbr:Walt_Disney_Studios_Motion_Pictures .
dbr:Deadpool_(film) a dbo:Film ;
  dbo:distributor dbr:20th_Century_Fox ;
  dbo:starring dbr:Ryan_Reynolds .
dbr:X-Men_Origins:_Wolverine a dbo:Film ;
  dbo:starring dbr:Hugh_Jackman ,
    dbr:Ryan_Reynolds .
dbr:Scarlett_Johansson a dbo:Person .
dbr:Robert_Downey_Jr. a dbo:Person .
dbr:Daniel_Brühl a dbo:Person .
dbr:Kevin_Feige a dbo:Person .
```

11. Select the correct query or queries to get all the starring actors of the film "Captain America: Civil War"!

a.
```
SELECT * WHERE {
  ?film dbo:starring ?actor .
}
```

b.
```
SELECT ?actor WHERE {
  ?actor a dbo:Person .
  ?film a dbo:Film .
  ?film dbo:starring ?actor .
}
```

c.
```
SELECT ?actor WHERE {
  ?film a dbo:Film .
  dbr:Captain_America:_Civil_War ?starring
?actor .
}
```

d.
```
SELECT ?actor WHERE {
  dbr:Captain_America:_Civil_War dbo:starr
ing ?actor .
}
```

e. None of the above

Consider the following RDF graph to answer the question:

```
@prefix dbo:<http://dbpedia.org/ontology/> .
@prefix dbr:<http://dbpedia.org/resource/> .
@prefix rdf:<http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs:<http://www.w3.org/2000/01/rdf-schema#> .

dbr:Sonic_Heroes rdf:type dbo:VideoGame ;
  dbo:gameArtist dbr:Kazuyuki_Hoshino ;
  rdfs:label "Sonic Heroes"@en .
dbr:Civilization_V rdf:type dbo:VideoGame ;
  dbo:series dbr:Civilization_series ;
  dbo:director dbr:Sid_Meier ;
  rdfs:label "Civilization V"@es ;
  dbo:releaseDate "1924-09-10"^^xsd:date .
dbr:Guitar_Hero_(video_game) rdf:type dbo:VideoGame ;
  dbo:gameArtist dbr:Ryan_Lesser ;
  rdfs:label "Guitar Hero"@en ;
  dbo:releaseDate "2015-06-06"^^xsd:date .
dbr:Tomb_Raider_(2013_video_game) rdf:type dbo:VideoGame ;
  dbo:developer dbr:Crystal_Dynamics ;
  dbo:series dbr:Tomb_Raider ;
```

```
rdfs:label "Tomb Raider (2013)"@en .
```

12. What is the result of this SPARQL query upon the given RDF Graph?

```
SELECT ?title WHERE {
  ?game dbo:gameArtist dbr:Ryan_Lesser
.
  ?game rdfs:label ?title .
}
```

a. "Civilization V"@es
b. "Guitar Hero"@en
c. "Sonic Heroes"@en
d. "Tomb Raider (2013)"@en
e. None of the above

13. Select the correct SPARQL query for "Give me all game titles which have the word "hero" in its title"!

a.

```
SELECT ?game WHERE {
  ?game rdfs:label ".*hero.*" .
}
```

b.

```
SELECT ?title WHERE {
  ?game rdfs:label ?title .
  FILTER REGEX(?title, "hero", "i")
}
```

c.

```
SELECT ?title WHERE {
  ?game rdfs:label ?title .
  FILTER REGEX("hero", "i")
}
```

d.

```
SELECT ?title WHERE {
  ?game rdfs:label ?title .
  FILTER(Regex(str( ?title ) , "hero")
)
}
```

e. None of the above

Consider the following RDF graph to answer the question:

```
@prefix rdf:  <http://www.w3.org/1999/
02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/
01/rdf-schema#> .
@prefix ex:   <http://example.org/Book
s#> .
@prefix xsd:  <http://www.w3.org/2001/
XMLSchema#> .
ex:J._K._Rowling rdf:type ex:Writer ;
  rdfs:label "J. K. Rowling"@en .
ex:J._R._R._Tolkien rdf:type ex:Writer
;
  rdfs:label "J. R. R. Tolkien"@de .
ex:Harry_Potter_and_the_Prisoner_of_Az
kaban rdfs:label "Harry Potter and the
Prisoner of Azkaban"@en ;
  ex:author ex:J._K._Rowling ;
  ex:numberOfPages "317"^^xsd:int .
ex:The_Hobbit rdfs:label "The Hobbit o
r There and Back Again"@en ;
  ex:author ex:J._R._R._Tolkien ;
  ex:numberOfPages "320"^^xsd:int .
```

14. What is the result of this SPARQL query upon the given RDF Graph?

```
SELECT (COUNT(?book) AS ?num_book) WHE
RE {
  ?book ex:author ?author ;
    ex:numberOfPages ?numberOfPages .
  FILTER( ?numberOfPages > 317 )
}
```

a. 0
b. 1
c. 2
d. 317
e. 320

15. Select the correct SPARQL query for *"Give me all games which have a spanish title"*!

a.

```
SELECT ?title WHERE {
  ?game dfs:label ?title .
  FILTER( ?title = "es" )
}
```

b.

```
SELECT ?title WHERE {
  ?game rdfs:label ?title .
  FILTER(lang(?title) = "es")
}
```

c.

```
SELECT ?title WHERE {
  ?game rdfs:label ?title .
  FILTER(lang(?title) = spanish)
}
```

d.

```
SELECT ?title WHERE {
  ?game rdfs:label ?title .
  FILTER(lang(@es))
}
```

e. None of the above

Question 2 [30 Marks – 1.5 Marks each]

Select the best answer from the given options. Fill in the answer on the answer sheet given on the last page. Answers not filled in the answer sheet will NOT be graded.

Note: The MCQ numbering is continued from Q1.

16. Select the correct SPARQL query for *"Give me all game titles and if present their release date, their series, and their director"*!

a.

```
SELECT ?title ?releasedate ?series ?direct
or WHERE {
  ?game rdfs:label ?title .
  OPTIONAL {
    ?game dbo:releaseDate ?releasedate .
    ?game dbo:series ?series .
    ?game dbo:director ?director }
}
```

b.

```
SELECT ?title OPTIONAL(?releasedate ?serie
s ?director) WHERE {
  ?game rdfs:label ?title .
  ?game dbo:releaseDate ?releasedate .
  ?game dbo:series ?series .
  ?game dbo:director ?director .
}
```

c.

```
SELECT ?title ?releasedate ?series ?direct
or WHERE {
  ?game rdfs:label ?title .
  ?game dbo:releaseDate OPTIONAL { ?releas
edate } .
  ?game dbo:series OPTIONAL { ?series } .
  ?game dbo:director OPTIONAL { ?director
} .
}
```

d.

```
SELECT ?title ?releasedate ?series ?direct
or WHERE {
  ?game rdfs:label ?title .
  OPTIONAL { ?game dbo:releaseDate ?releas
edate }
  OPTIONAL { ?game dbo:series ?series }
  OPTIONAL { ?game dbo:director ?director
}
}
```

e. None of the above

17. Select the correct statement(s) about ontologies.

I. Classes are characterised via attributes.
II. Relations are special classes, whose values are attributes.
III. Relations are special attributes, whose values are objects of (other) classes.
IV. For relations and attributes, constraints can be defined that determine valid values.

a. II only
b. I, III and IV only
c. III and IV
d. II and IV only
e. I, II, III and IV only

18. What are the difference(s) between object properties and datatype properties?

I. The domain of an object property is a class and the domain of an datatype property is a datatype.
II. Object properties are only part of the OWL Abox and datatype properties are only part of the OWL TBox.
III. The range of an object property is a class and the range of an datatype property is a datatype.
IV. Object properties can be connected by owl:propertyChainAxiom, datatype properties cannot be connected by owl:propertyChainAxiom.
V. Object properties are only part of the OWL Tbox and datatype properties are only part of the OWL ABox.

a. II only
b. II and IV only
c. II, IV and V only
d. III and IV only
e. I, II, III and IV only

19. Select the correct order of steps of the Ontology 101 method:

1. Determine Domain and Focus
2. Definition of Individuals
3. Development of a Terminology
4. Development of Classes and Class Hierarchies
5. Definition of Property Constraints
6. Definition of Properties
7. Consider Reuse

a. 1 - 7 - 3 - 4 - 6 - 5 - 2
b. 1 - 7 - 3 - 4 - 5 - 6 - 2
c. 1 - 7 - 3 - 6 - 4 - 5 - 2
d. 1 - 3 - 7 - 6 - 5 - 2 - 4
e. 1 - 3 - 7 - 4 - 6 - 5 - 2

20. What are competency questions in ontology development?

I. Questions about the skills of the domain experts.
II. Questions that should be answered by the knowledge represented in the ontology.
III. Questions that help defining the domain of the ontology.
IV. Questions about the skills of the ontology developers.
V. Questions that determine the next step in the ontology design process.

a. II and III only
b. I, II, III and IV only
c. III, IV and V only
d. II, III and V only
e. III only

21. Select the correct statement(s) about ontology design.

I. When designing an ontology, there should always be as many and as specific constraints as possible.
II. Ontology design always starts with first creating the broader more general classes, followed by adding narrower and more specific ones.
III. An ontology should be developed only by ontology experts to avoid design errors.
IV. Ontology design is an iterative process that repeats continuously.

a. I and III only
b. I and IV only
c. I, II, and III only
d. I, II, III and IV
e. IV only

22. Which approaches have to be considered for the class hierarchy design?

I. V-model
II. Terminology-based
III. Extreme design
IV. Top-down
V. Bottom-up
VI. Middle-out

a. IV only
b. I, III and IV only
c. IV, V and VI only
d. III and IV only
e. I, II and IV only

23. Which statement(s) describe drawbacks of RDFS compared to OWL ontologies?

I. Disjunctive classes cannot be defined.
II. Class instances cannot be defined.
III. Taxonomies cannot be defined.
IV. Negations cannot be defined.
V. Cardinality constraints cannot be defined.

a. I and IV only
b. II and IV only
c. II, IV and V only
d. III and IV only
e. I, IV and V only

24. Select all property constraints relevant to OWL ontologies.

I. Symmetry
II. Uniqueness
III. Transitivity
IV. Cardinality
V. Inversiveness

a. I, II and III only
b. II and IV only
c. I, II, III and V only
d. III and IV only
e. All I-V

25. What elements are required to speak a common language?

I. Semantics
II. Syntax
III. Ontologies
IV. Thesauri
V. Taxonomies

a. I and II only
b. II and IV only
c. II, IV and V only
d. III and IV only
e. All I-V

26. What additional properties make an abstract model an ontology?

I. It is a shared model.
II. It is a formal model.
III. It is an unshared model.
IV. It is an informal model.
V. It is an explicit model.
VI. It is an implicit model.

a. I and II only
b. I, II and IV only
c. II, IV and V only
d. III and IV only
e. I, II, and V only

27. Which elements are used to define a formal ontology model?

I. Textual descriptions
II. List of properties
III. Instances
IV. Classes
V. Attributes

a. II only
b. II and IV only
c. III, IV and V only
d. III and IV only
e. I, II, III and IV only

28. Select the proper definition of the equivalence of classes :Sheep and :Balloonist in Turtle syntax.

a. :Sheep owl:equals :Balloonist .
b. :Sheep owl:equivalent :Balloonist .
c. :Sheep owl:equivalentClass :Balloonist .
d. All of the above
e. None of the above

29. What is included in an ontology?

I. every possible name for an item
II. definitions of class hierarchies
III. definitions of properties
IV. restrictions and constraints on how entities can be connected
V. the logical inferences that can be made from arbitrary facts

a. I and II only
b. I and III only
c. II, III and IV only
d. I, II, III and IV only
e. II, III , IV and V only

30. Select the correct statements about an ontology?

I. An ontology consists of a single class whose meaning varies depending on the application context
II. An ontology helps to share a common understanding of the structure of information among people or software agents
III. An ontology is an explicit, formal specification of a shared conceptualization
IV. An ontology refers to a model that contains a set of classes plus a set of relations between them

a. I only
b. I, II, III and IV
c. II, III and IV only
d. II and III only
e. I, II and III only

31. Select the correct statements about the Open World Assumption (OWA).

VI. In OWA anything that cannot be shown to be true towards a particular knowledge base is unknown
VII. In OWA everything is always possible
VIII. In OWA incomplete knowledge about individuals is assumed
IX. In OWA the knowledge base needs to contain all possible individuals

a. I only
b. II and III only
c. I, III and IV
d. I, II and IV only
e. I and III only

32. Which of the following is/are the building block(s) of OWL axioms?

I. Individuals
II. Namespaces
III. Properties
IV. Classes

a. I, II, and III only
b. I and IV only
c. I, II, III and IV
d. I, III and IV only
e. IV only

33. Select the correct statement(s) about OWL.

I. OWL is a semantic fragment of First Order Logic.
II. OWL is a family of knowledge representation languages for authoring ontologies.
III. An OWL Ontology describes a domain in terms of classes, properties and individuals. However, it never contains any description on the characteristics of the objects.
IV. OWL2 is based on Description Logic.

V. OWL also exists in different flavors such as OWL EL, OWL RL

a. I and IV only
b. I and IV only
c. I, II, and III only
d. II, IV and V
e. I, II, IV and V only

34. Identify the correct inference statement from the given information.

```
:isBiggerThan a owl:ObjectProperty ;
              a owl:TransitiveProperty
;
              rdfs:domain owl:Planet ;
              rdfs:range owl:Planet .
:Uranus a owl:Planet ;
        :isBiggerThan :Neptune .
:Saturn a owl:Planet ;
        :isBiggerThan :Uranus .
```

a. :Saturn :isBiggerThan :Neptune .
b. :Neptune :isBiggerThan :Neptune .
c. :Neptune :isBiggerThan :Saturn .
d. :Uranus :isBiggerThan :Saturn .
e. None of the Above

35. Select the required property relations, which are left out of the set of statements, to make the given inference valid. Each list item is independent from the other items.

1. {p(a,b), p(a,c)} ⊨ b = c
2. {p(a,b)} ⊨ p(b,a)
3. {p(a,b)} ⊨ a ≠ b

a. 1. p is a reflexive property.
   2. p is a functional property.
   3. p is a irreflexive property.

b. 1. p is a transitive property.
   2. p is a asymmetric property.
   3. p is a functional property.

c. 1. p is a functional property.
   2. p is a symmetric property.
   3. p is a irreflexive property.

d. 1. p is a transitive property.
   2. p is a symmetic property.
   3. p is a reflexive property.

e. None of the above