SSY145 Wireless Networks

Question Bank

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Contents

1 For Exam

1.1 Article #02a & #02b – "Whitesides' Group: Writing a Paper" & "Analyzing the Past to Prepare for the Future: Writing a Literature Review"

1. Which of the following statement is(are) correct about sections of an academic paper according to George M. Whitesides?

   (a) The abstract should be done at the beginning of writing a paper.

   (b) The Conclusion section of an academic paper should be written as a list of short phrases or sentences.

   (c) The results and discussion are usually combined.

   (d) The main purpose of the Conclusion section is to shortly repeat what is in the Results section.

2. Which of the following statement is(are) correct about constructing an outline of a paper according to George M. Whitesides?

   (a) An outline should contain significant amount of text to be readable.

   (b) One should start to construct an outline after finishing a project.

   (c) The outline should be organized around text.

   (d) None of the above.

3. Which of the following statement is(are) correct about academic writing style?

   (a) Complete all comparisons.

   (b) Use the passive voice whenever possible to make long sentences.

   (c) The word "this" must always be followed by a noun, so that its reference is explicit.

   (d) Nouns can be used as adjectives, e.g. reaction product, ATP formation.

4. Which of the following statement is(are) false?

   (a) The objectives of a paper when it is finished are often the same as those used to justify starting the work, that's a reason why an outline is important.

   (b) A paper should be organized in chronological order so that the reader can follow how you arrive at your result.

   (c) A literature review is author-centric and should be a summary of the relevant articles.

   (d) A review should identify critical knowledge gaps and thus motivate research to close these gaps.

5. Which of the following statement is(are) correct about the tense in an academic paper?

   (a) When describing experimental results, use the present tense.

(b) When attributing a statement or idea to a person, use the past tense.

(c) When discussing concepts, use the present tense.

(d) None of the above.

6. Which of the following statement is(are) correct about the outline of a paper?

(a) Once the outline is finished after careful thinking, one should follow the outline and not do significant additional work.

(b) The outline should be organized in order of importance.

(c) The section headings should be as short as possible to be faster for readers to process.

(d) None of the above.

7. Which of the following elements should the Introduction of an article contain in general?

(a) Background

(b) The justification for the objectives of the work.

(c) Summary of what the reader should expect as conclusions of the paper.

(d) Guidance to the reader.

8. Which of the following statement for the theoretical development of an article is(are) false?

(a) In contrast to variance theories, process theories use events and states to help explain dynamic phenomena. Thus, in a review, the results of variance and process research are independent elements.

(b) Variance theories incorporate dependent variables that cause variation in independent variables.

(c) Models and propositions capture relationships between variables and represent theories.

(d) Extending current theories is a difficult task and is often the weakest part of a review, so it is the least important part of a review.

1.2 C1 – "Academic Technical Writing"

1. Which of the following is/are acceptable approach(es) to Referencing?

(a) Quote a paragraph by placing it in quotation marks and acknowledge the source.

(b) Take some short fixed phrases from several different sources and put them together with some of your own words.

(c) Copy a paragraph making only small changes. For example, replace some words with words with similar meanings.

(d) Paraphrase a paragraph: rewrite the paragraph but change the language, organisation and detail, and give your own examples.

2. Which of the following is/are the correct way(s) of using acronyms?
   (a) Include a table in the Results section.
   (b) Attach an appendix or index to the report.
   (c) Define them when their expansions first appear and use them after they have been displayed in full.
   (d) Use only very well known acronyms to avoid defining them.

3. Which of the following statements about graphics is/are true?
   (a) Figures and tables must be labeled.
   (b) A table is needed after every figure in order to explain it.
   (c) Tables do not need to be labeled.
   (d) Figures and tables must be referred to in the text.

4. Which of the following is/are correct way(s) of using "THAT"?
   (a) when you are adding helpful additional material, and use commas
   (b) when you are including essential material, and do not use commas
   (c) when you are including essential material, and use commas
   (d) when you are adding helpful additional material, and do not use commas

5. Which of the following is/are correct about adverbial?
   (a) Divide a dependent clause from an independent one.
   (b) Adverbials are dependent phrases or words that describe how, when, or where some action is done.
   (c) An adverbial generally won't change the subject-verb order in English.
   (d) All of the choices.

6. Which of the following statements about the use of references is(are) false?
   (a) Provide expert information/knowledge.
   (b) Keep you (and your readers) up to date on the latest developments in the field.
   (c) Give your readers high-quality information and thereby increase their trust in you.
   (d) None of the choices.

7. Which of the following statements is(are) correct about the IEEE reference list structure?
   (a) The references are arranged chronologically according to their publication date.
   (b) The references are arranged in the order of appearance of the text citations.
   (c) The references are arranged alphabetically with respect to the author's name.
   (d) None of the choices.

8. Which of the following is/are incorrect about text structure and grammar?
   (a) "Heavy" adverbials are often placed at the beginnings of sentences.
   (b) "That" is used when a sentence adds helpful additional material.
   (c) In academic writing, objective writing is recommended than first-person or second person pronouns.
   (d) In order to use formal expressions, it is required to avoid using contractions.

9. What information is compulsory to be given when commenting data?
   (a) Compare/assess data relative 'X'.
   (b) Highlight(s)
   (c) Location and summary
   (d) Unexpected results / reliability / validity

10. Which of the following is/are true about academic writing?
   (a) Writer should use more 1^{st} -person pronouns in order to make their statement straightforward.
   (b) Writer should indent the first line of each paragraph and leaves an empty line between each paragraph.
   (c) Contraction such as "you're" should be avoided in formal writing.
   (d) Every periods within the text could be replaced by semicolons.

11. Which of the following statement is(are) correct about figures and tables in a paper?
   (a) Figures and tables do not have to be labeled if they are referred to in text.
   (b) Figures and tables do not have to be referred to in text if they are labeled.
   (c) Figures and tables must be labeled and referred to in text.
   (d) A paper should only contain text and not figures or tables.

12. Which of the following use of "That" and "Which" is correct?
   (a) "That" should be used when you are adding helpful addition materials, and do not use commas.
   (b) "That" should be used when you are including essential material, and do not use commas.
   (c) "Which" should be used when you are adding helpful addition materials, and do not use commas.
   (d) "Which" should be used when you are adding helpful addition materials, and use commas.

13. According to Kathryn Strong Hansen, if someone asked the questions "Who founded Microsoft?" and "What is the company's name?", which of the following sentences is/are correct answers to these two questions?

(a) The company, which is called Microsoft, is founded by Bill Gates.

(b) The company that is called Microsoft is founded by Bill Gates.

(c) The company, which is founded by Bill Gates, is called Microsoft.

(d) The company that is founded by Bill Gates is called Microsoft.

14. What was said in the lecture Academic Technical Writing?

(a) Semicolon can be used in some cases but it is optional.

(b) As long as you mention the original writer's name, you can use this information as a source.

(c) "That" and "which" are used in the same way.

(d) The IMRaD structure should be used whenever writing a report.

15. According to Kathryn Strong Hansen, style and language are very important for academic writing. Considering formality, conciseness and objectivity, which of the following sentences is the best?

(a) It was noted that, after having been tested, the medicine was ineffective.

(b) We noted that, after testing, the medicine was ineffective.

(c) Tests showed that our medicine was really ineffective.

(d) Tests showed that the medicine was ineffective.

16. Which of the following statements is/are correct about reference?

(a) In the reference end list, references should be organized by the order in which they appear in the text.

(b) One of the reason for using references is providing expert information/knowledge.

(c) References can give your readers high-quality information and thereby increase their trust in you.

(d) Referencing has two parts: in the text and in the reference list.

17. Which of the following is/are correct in the academic technical writing?

(a) Writing papers from the Introduction section is the most efficient way.

(b) In an outline, the Conclusion section is just the summary of the paper.

(c) Tables and equations can be used to compress the information and make the paper shorter and more readable.

(d) A review succeeds when it helps other scholars to make sense of the accumulated knowledge on a topic.

1.3 Article #04 – "Evolution of LTE toward IMT-Advanced"

1. Which of the following statement(s) is(are) false about LTE-advanced?
   (a) Carrier aggregation capable terminal receives only the primary component carrier, this increases the terminal's power consumption.
   (b) Transmission bandwidth can extended by means of carrier aggregation.
   (c) Discrete fourier transform spread OFDM is used in the uplink.
   (d) In cross-carrier scheduling, the scheduling decision is transmitted to the terminal on the same component carrier of corresponding data.

2. Which of the following statement(s) is(are) correct about LTE-advanced?
   (a) In inband relaying the donor-relay link operate on a different frequency.
   (b) In outband relaying the donor-relay link operate on the same frequency.
   (c) Network densification is one possible method to increase overall network capacity.
   (d) For better network performance, separate carrier should be used for closed subscriber group(CSG) cells.

3. Suppose you have a mobile device supporting LTE Release 10 and you are in a city with LTE Release 8 base stations. Which of the following scenarios are possible?
   (a) Mobile device will fail to connect to the base station.
   (b) Mobile device will connect to base station and operate normally.
   (c) Mobile device will connect to base station only if it is an Apple device.
   (d) The base station will update itself to LTE Release 10 since the mobile device is LTE Release 10.

4. Which of the following statement(s) is(are) true regarding heterogeneous deployments ?
   (a) Support for heterogeneous deployments includes carrier aggregation.
   (b) Heterogeneous deployment is possible with LTE Release 8.
   (c) In heterogeneous deployment the best cell for downlink is the one with lowest path loss.
   (d) Cell association strategy can lead to different uplink and downlink coverage area.

5. Which of the following statement(s) is(are) true regarding LTE Release 10 enhancements?
   (a) Carrier aggregation provides increased data rates by coalescing noncontiguous bandwidths.
   (b) Heterogeneous deployment provides increased data rates by allowing hierarchical cell structure.
   (c) In Heterogeneous deployment the pico cells are always wirelessly connected to macro cell basestation.

(d) Relaying increases coverage while Heterogeneous deployment increases data rate.

6. How does LTE Release 10 achieve backward compatibility with LTE Release 8 for carrier aggregation?

(a) Carrier aggregation in LTE Release 10 is not compatible with LTE Release 8.

(b) Each component carrier has LTE Release 8 structure, and hence, carrier aggregation is backward compatible.

(c) Carrier aggregation is already available in LTE Release 8. So there are no compatibility issues.

(d) A special software update is needed for LTE Release 8 terminals to support carrier aggregation capable LTE Release 10 devices.

7. Which of the following is an LTE Release 10 enhancement?

(a) Possibility to have control signals for different cell layers separated in frequency or time.

(b) Support for 4-layer spatially multiplexed downlink transmission using multiple antennas.

(c) Capability to have an aggregated transmission bandwidth of 200 MHz.

(d) None of these choices.

1.4 C2 – "Basic Principles of Wireless Networks"

1. In order to greatly reduce the effect of delay spread, which of the following is/are are being used at the receiver side?

(a) Power adaptation

(b) Spread spectrum

(c) Equalization at the receiver

(d) Multicarrier modulation

2. Which of the following is/are false about diversity?

(a) Independent signal paths have a high probability of experiencing deep fades simultaneously.

(b) The output SNR with Selection Combining improves linearly with the number of diversity branches.

(c) Independent fading paths can be achieved by separating the signal in time, frequency, space, and polarization, etc.

(d) To realize diversity, the same information should be sent over dependently fading radio.

3. Which property/properties can be used to modulate information on a signal?

(a) Amplitude

(b) Phase

(c) Frequency

(d) Amplitude and phase together

4. Which of the following is/are the issue(s) of multicarrier modulation (OFDM not included)?

(a) It requires reliable feedback channel and accurate channel estimation.

(b) Large bandwidth penalty.

(c) Expensive.

(d) Total data rate is changed for N subcarriers with rate R/N.

5. Which of the following statements is/are true about the Cyclic Prefix of an OFDM symbol?

(a) The length of the cyclic prefix should not be longer than the delay spread of the channel.

(b) A longer cyclic prefix length introduces losses in data rate.

(c) The cyclic prefix is a fixed set of symbols known by both the transmitter and reciever.

(d) The cyclic prefix tricks the reciever that the signal is periodic, thus providing a circular convolution.

6. Which of the following is/are false for modeling pass loss?

(a) Maxwell's equations are complex and impractical.

(b) Free space path loss model is close to reality.

(c) Ray tracing models require site-specific information.

(d) Simplified power falloff models are good for high-level analysis.

7. A channel introduces a lot of amplitude noise but almost no phase noise. Which of the following constellations is(are) suitable for this channel?

(a) QPSK

(b) 32-QAM

(c) 16-PSK

(d) 8-QAM

8. Which of the following is/are true about flat fading countermeasures?

(a) Independent signal paths are likely to experience deep fades simultaneously, therefore the diversity combining techniques are ineffective.

(b) Channel coding techniques make a trade-off between improving bit error rate and maintaining data rate.

(c) The basic principle of interleaving in channel coding is to spread the burst errors over many codewords.

(d) Automatic Repeat Request (ARQ) is a power efficient technique.

9. Which of the following characteristics can be issues of multicarrier modulation (OFDM not included)?

(a) Large bandwidth penalty.

(b) Very high quality (expensive) low pass filters.

(c) More ISI when a large number of narrowband carriers are sent.

(d) None of the above.

10. Which of the following is/are true about the diversity combining technique Selection Combining?

(a) All branches are coherently combined with equal weights.

(b) All branches are coherently combined with weights which depend on the branch SNR.

(c) Picks the branch with the highest SNR.

(d) None of the above.

11. which one of the following factors does not affect small scale fading?

(a) Transmission bandwidth of the signal

(b) Multipath propagation

(c) Power density of the base station

(d) Speed of mobile

12. Which of the following belong(s) to large scale fading?

(a) Path loss

(b) Shadowing

(c) Multipath fading

(d) All of the above.

13. What is true regarding Orthogonal Frequency-Division Multiplexing (OFDM) and Multicarrier Modulation?

(a) The delay spread must be larger than the guard band to avoid ISI between symbols.

(b) OFDM divides a wideband signal into multiple smaller narrowband subcarriers to avoid frequency-selective fading.

(c) One downside with OFDM is that it is not very spectrum efficient.

(d) The cyclic prefix is used to eliminate the Inter Symbol Interference (ISI).

14. Which of the following statement is/are correct about adaptive techniques?

(a) Implementing adaptive modulation will increase transmitter and receiver complexity.

(b) Adaptive modulation can be utilized without good feedback channel.

(c) Adaptive modulation has potential for large increase in spectral efficiency, this improvement comes at the expense of increased signal bandwidth or a lower data rate.

(d) There are three types of Automatic Repeat Request, including Stop-and-Wait, Go-Back-N, and Selective-Repeat.

15. Which of the following is/are correct in Lecture 3?

(a) There is Doppler effects in fast fading, and it is a time variant system.

(b) The key point for MIMO to improve the performance is separating the signal in frequency dimension.

(c) Channel coding is a linear approach to reduce error probability.

(d) In OFDM, the delay spread should not be greater than guard band duration, otherwise, there will be ISI.

1.5 Review questions of Lecture #03 – "Basic Principles of Wireless Networks"

Part I:

1. Explain the difference between path loss and shadowing? What is the impact of shadowing on cell design?

2. What is flat fading and how is it different from AWGN? Why is Rayleigh good statistical model for flat fading?

3. How exactly does multi-path fading lead to frequency-selectivity and ISI in a broadband channel?

4. How exactly does mobility lead to time-selectivity in the channel?

5. What are the basic link performance measures? Explain each.

Part II:

1. Interleaving is one way to create diversity in fading channels. Explain briefly how interleaving helps to create diversity.

2. There are several sources of interference in wireless networks: inter-symbol interference (AWGN channels due to poor pulse-shaping; multi-path frequency-selective channels), inter-cell interference, intra-cell interference (CDMA), and inter-carrier interference (in OFDM). Briefly explain why each of these interference phenomena arise. How do techniques like pulse-shaping, spread spectrum/Rake, equalizers and OFDM deal with the ISI problem?

3. The cyclic prefix in multicarrier modulation serves as a time gap (a guard interval) between consecutive data blocks. Why is cyclic prefix used instead of a simpler guard interval?

4. Name two channel-related irreducible probability of error phenomena, and briefly describe the nature of each one. What is their relationship with the coherence bandwidth and Doppler spread of the channel?

1.6 Article #05 – "mmWave-5G"

1. Which of the following statements is/are NOT correct about 5G?
   (a) 5G promises twenty times peak data rates compared to LTE.
   (b) 5G is allocated the millimeter wave frequency band (6–100GHz).
   (c) 5G will have dense smaller cells compared to LTE.
   (d) All of the choices.

2. Which of the following statements is/are correct about millimeter wave communication?
   (a) Antenna arrays are possible using millimeter waves because of small size of each antenna element.
   (b) Penetration losses are higher for millimeter waves compared with waves with lower wavelength.
   (c) Fading channel matrices in millimeter wave communication are sparse.
   (d) Low resolution ADCs is used to improve energy efficiency in millimeter wave communication.

3. Which of the following statements is/are correct about millimeter wave communication?
   (a) Digital beamforming in millimeter wave communication is complex to implement if we require maximum performance.
   (b) Hybrid beamforming, which is proposed for millimeter wave communication, involves operations in analog domain as well as digital domain.
   (c) "Dirty RF" concept proposes to compensate for non-ideal hardware in digital baseband processing.
   (d) Noise in reference clocks can lead to phase noise.

1.7 C3 – "From 4G to 5G and Beyond, part 1"

1. When a UE is in the connected state, which of the following will happen?
   (a) The UE sends out paging information to the network about its channel characteristics.
   (b) The UE updates the Downlink control information (DCI) among other UEs.
   (c) The UE searches for candidate cells. If a stronger cell is detected, it then informs the network.

(d) The networks decides if a handover to a neighboring cell is needed or not.

2. Which of the following is/are false about spectrum in LTE?
   (a) Licensed spectrum allows for relatively high output power and long range.
   (b) Unpaired spectrum (TDD) uses only unlicensed bands.
   (c) LTE supports both FDD and TDD with a single radio-access technology.
   (d) There is a control of the interference situation on both licensed and unlicensed spectrum.

3. Which of the following statement(s) is/are true about carrier aggregation?
   (a) Inter-band aggregation means that frequencies of the same frequency band are aggregated.
   (b) The reasons to do carrier aggregation is to exploit fragmented spectrum and achieve higher data rates due to more bandwidth.
   (c) Intra-band aggregation only works if the frequencies are located next to each other.
   (d) It uses multiple carriers in parallel.

4. Which of the following is/are true about licensed spectrum ?
   (a) Exclusive right to a certain frequency range
   (b) Control of the interference situation
   (c) Typically associated with no license cost
   (d) Relatively low output power and short range of coverage

5. What information does a base station need to have in order to schedule uplink for a user?
   (a) A so called Buffer Status Report (BSR) which tells the base station how much data is in the buffers.
   (b) Channel-state information (CSI).
   (c) The UE's battery life.
   (d) Information that a user has data ready to transfer (scheduling request).

6. Which of the following is/are a correct sentence?
   (a) Round Robing scheduling is a way that assigns the channel to the user with the best absolute quality.
   (b) High reliability is one of the things that we require from a wireless system.
   (c) Proportional Fair (PF) is a scheduling that cyclically assigns the channel to users, not taking quality conditions into account
   (d) Max/CI provides high throughput and is fair as well.

7. Which of the following is/are true about license-assisted access (LAA)?

(a) Carrier aggregation is used to combine licensed and unlicensed spectrum.

(b) LAA use the 2.4 Ghz and 5 Ghz band.

(c) LTE does not use unlicensed spectrum.

(d) Listen-before-talk is required for unlicensed carriers.

8. Which of the following is/are true about error control in LTE?

(a) Hybrid-ARQ is slower than RLC retransmissions.

(b) Hybrid-ARQ indicates success/failure outband after reception of each 1 ms subframe of data.

(c) Because of the incremental redundancy supported by Hybrid-ARQ, the initial transmission could have two times the code rate as the first retransmission.

(d) RLC retransmissions handle most of the errors.

9. Which of the following is/are true about licensed spectrum?

(a) Anyone can use the given frequencies.

(b) Exclusive right to a certain frequency range

(c) Control of the interference situation

(d) Relatively low output power and short range

10. Which of the following is/are true about downlink control information (DCI) in scheduling and link adaptation?

(a) Downlink control information (DCI) informs the UE about MIMO layers.

(b) Downlink control information (DCI) informs the UE about time/frequency resources.

(c) Downlink control information (DCI) informs the UE about modulation scheme and code rate.

(d) None of the above

11. What is the largest bandwidth a UE is required to support in LTE?

(a) 5 MHz

(b) 1.4 MHz

(c) 20 MHz

(d) 15 MHz

12. Which of the following is/are the meaning of “global standard” ?

(a) merge of different standards

(b) faster network

(c) support larger user base

(d) lower latency

13. Which of the following statements is/are correct about uplink and downlink?

(a) For both uplink and downlink we have a scheduler that tells the UE what to do.

(b) Buffer status report is used to inform the UE of how much data the base station expects to receive.

(c) The UE sporadically reports the channel-state-information to the base station, containing information of the downlink channel quality.

(d) The power headroom report is used to inform a base station of the amount of available output power.

14. Which of the following statements is/are true regarding lecture 4?

(a) The main requirements for 4G performance can be visualized with "the spider diagram", with axes of mobility and peak data rate.

(b) Many of today's mobile subscription users are not human but e.g cars.

(c) One good scheduling technique is using dedicated channels for each device/user since it is very efficient.

(d) It is always best to choose scheduling type based on the full buffer traffic.

15. Among the following implementations in LTE protocol stack, which is/are NOT in radio link control (RLC)?

(a) Coding and Modulation

(b) RLC retransmissions

(c) Hybrid-ARQ retransmissions

(d) Header compression to reduce overhead

16. Which of the following is/are correct about scheduling?

(a) Max C/I scheduling scheme always have a higher system throughput compared with Proportional Fair.

(b) Since rate adaptation is used in scheduling, the modulation scheme is determined in this part.

(c) In order to make the most of traffic situation, the dedicated channel is the best choice.

(d) Round Robin considers quality conditions into account but has poor performance.

1.8 Article #06a – "NR: The New 5G Radio Access Technology" #06b – "5G NR evolution"

1. Which of the following is(are) true about 5G NR?

(a) NR is designed to co-exist with LTE through interworking

(b) NR is designed for forward compatibility

(c) NR is based on OFDM

(d) NR supports both TDD and FDD

2. Which of the following information is transmitted in physical uplink control channel?
   (a) Hybrid ARQ acknowledgement
   (b) Channel-state feedback for multi-antenna operation
   (c) Number of mobile devices in the cell
   (d) Scheduling request for downlink data awaiting transmission

3. Which of the following is true about channel codes in 5G NR?
   (a) LDPC codes with no hybrid ARQ is used in smallest control payloads.
   (b) Reed-Muller and polar codes are used in control channels.
   (c) LDPC codes with hybrid ARQ is used for data transmissions.
   (d) None of the above.

4. Which of the following statements is true?
   (a) Measurement configuration and reporting does not take place until the UE enters the fully connected state in 5G NR release 16.
   (b) The number of rate-matching patterns available in NR has been increased in 5G NR release 16.
   (c) 5G NR release 16 enables NR operation in unlicensed spectrum, targeting the 5GHz and 6GHz unlicensed bands.
   (d) 5G NR release 17 enhances many existing features and functionalities, such as paging collision avoidance and supporting NR from 52.6GHz to 71GHz.

1.9 C4 – "Challenges and Opportunities with mmWave Communications in 5G"

1. Based on specific used cases, which of the following is/are the advantage of mm-waves?
   (a) They can be used for virtually any wireless communication, offering infinite bandwidth.
   (b) It allows for dense frequency re-use, even with unfavourable propagation characteristics.
   (c) It offers a possibility for contiguous bandwdith, leading to potentially high data rate and low latency.
   (d) Due to high directionality of antennas used for mmWave communication, it offers less interference.

2. Why are relays useful?
   (a) Because they help to increase the capacity inside the area of the base station.

(b) Because they extend the area covered by the base station.

(c) To make the capacity more uniform by putting the relays outside the coverage area of the base station.

(d) To make use of the multi-hop approach in a distributive way by donating time slots from the base station.

3. Which of the following is/are true about coordinated multipoint (CoMP) architectures?

(a) Each Base station has to do the scheduling on its own.

(b) Different CoMP architectures can have base stations, remote radio units and relay stations.

(c) Every CoMP architecture is meant to work without a central unit for transmission control.

(d) Coordinated mulit-cell transmission and reception has the potential to improve the outage capacity and to smoothen the capacity over the cell areas.

4. Which of the following is/are true about coordinated scheduling and/or beamforming?

(a) Data to a single user is instantaneously transmitted from one of the transmission points.

(b) Data to a single user is simultaneously transmitted from multiple transmission points

(c) Scheduling decisions are coordinated to control e.g. the interference generated in a set of coordinated cells.

(d) It can improve the outage capacity and to smoothen the capacity over the cell areas.

5. What differences are there between the CoMP approaches of coordinated scheduling and/or beamforming vs coordinated joint processing/transmission?

(a) Data is transmitted from one transmission point for the scheduling/beamforming approach and from multiple points for the joint processing/transmission approach.

(b) The scheduling/beamforming approach requires only exchange of control data beween nodes and the joint processing/transmission approach requires only exchange of user data between nodes.

(c) The joint processing/transmission approach is more advanced and complex than the scheduling/beamforming approach.

(d) The scheduling/beamforming approach can be seen as a point-to-point-like network and the joint processing/transmission approach can be seen as a star-like network with a central unit.

6. Which of the following statements is/are incorrect?

(a) Intercell interference is a major challenge in wide area deployments for the WINNER system concept.

(b) IMT-Advanced is the 3G systems family.

(c) For 5G, the ITU-R system family is called IMT-2020.

(d) Coordinated scheduling/beamforming over multiple cells has the potential to lower the interference levels in a frequency reuse one system.

7. When using beamforming, which of the following describe(s) the genetic algorithm (GA)-based search?

(a) First find the queen then adjust the queen by making small changes or replacing random columns.

(b) First find the queen then adjust the queen by changing columns to their neighbors.

(c) Successively beamform each user with interference from previous users.

(d) Find the queen roughly with wide beams in the first-level codebook then steer to narrow beams by the second level codebook.

8. Which of the following is/are true about Coordinated Multi-Point (CoMP) schemes?

(a) In coordinated joint processing, data to a single user is transmitted from single transmission point.

(b) In coordinated scheduling, only the exchange of control data is required between nodes.

(c) CoMP intends to solve the problem that cell edge users obtain only fraction of the average throughput in conventional LTE system.

(d) Feedback links and backhaul links introduce latency to the transmission loop of central unit (CU).

9. Which of the following is/are use case(s) in mmMAGIC?

(a) Dense urban society with distributed crowds

(b) Immerse 5G early experience (hot spots)

(c) Moving hot spots

(d) Media on demand

10. What is true about the CoMP approaches?

(a) Coordinated scheduling and/or beamforming requires exchange of control data only between nodes.

(b) Coordinated joint processing/transmission doesn't require exchange of user data.

(c) Coordinated scheduling and/or beamforming have data transmitted to a single user from one transmission point.

(d) Coordinated joint processing/transmission transmitts data to a single user from multiple transmission points.

11. Which of the following is/are true regarding standards and different technologies mentioned in lecture 5?

(a) The IMT-Advanced defines capabilities that go beyond 4G systems.

(b) One important concept for the WINNER system was cooperation between different standards.

(c) Relaying is important since it enables extended coverage but also for its possibility to get more uniform capacity in cells.

(d) It is best to streamline different standards once the technology is widespread since it is easiest to make them compatible and minimize complexity once they're developed.

12. Which of the following statements is/are correct?

(a) One of the advantages of mm-waves for selected use cases is that the high directionality of antennas needed for mmWave transmissions causes less interference to other systems.

(b) MmMAGIC aims to collaborate with other 5G PPP projects, towards achieving a common set of 5G PPP KPIs.

(c) There are several use cases in mmMAGIC, including cloud services, moving hot spots, smart offices, etc.

(d) None of the above

13. Which of the following is/are false about Coordinated Multi-Point(CoMP)?

(a) The data can be transmitted to one user from multiple transmission nodes in beam forming.

(b) Coordinated joint processing only demands interchange of the user data.

(c) The characteristic of cellular structure with CoMp is: the capacity has fixed coordinates.

(d) All of the choices.

1.10 Article #07 – "5G technologies for the connected car"

1. Which of the following create unique challenges for V2X communications compared to other communication systems?

(a) High antenna heights.

(b) High speed of the vehicles.

(c) Dynamic surroundings.

(d) All of the above.

2. Which of the following statements is/are the key open research topics about integrated moving networks?

(a) Track a large set of mobile channels at a high speed to enable advanced spectrally efficient and robust closed loop MIMO schemes in the moving backhaul links.

(b) Design close-loop and cooperative interference coordination techniques in ultradence heterogeneous networks. communication are sparse.

(c) Resource allocation and resource slicing for versatile quality of services to meet key performance targets on outage, throughput, latency, and energy efficiency.

(d) Enable efficient mobility protocols in such integrated moving networks.

1.11 Article #08 – "Spectrum management"

1. Which of the following statement(s) is(are) true about spectrum management?

(a) Avoiding interference is one of the probable reasons for spectrum utilization agreement in 1903.

(b) The ITU is in charge of deciding between administrative model, trading model or free model for spectrum management.

(c) In trading model, the rights for spectrum usage can be sold and bought.

(d) WLAN is an example of a success story for spectrum commons.

2. Which of the following is(are) true?

(a) Fragmented spectrum will require devices to handle more interference scenarios.

(b) Fragmented spectrum calls for aggregation of narrow frequency bands.

(c) The downside of spectrum commons approach is imminent congestion due to increasing number of users.

(d) There is a general trend towards more frequency bands being allocated to spectrum commons.

1.12 C5 – "From 4G to 5G and Beyond, part 2"

1. Which of the following is/are correct about network slicing ?

(a) It involves deployment of different access gNB for different services

(b) It involves the telecom operator which logically re-planning its frequency spectrum for various services.

(c) It involves the control, or signaling data, riding on the 4G LTE network.

(d) It involves the logical separation of services at the core network into multiple virtual networks that operate on the same gNB.

2. Which of the following is/are advantage(s) of not restricting transmission to slot boundaries?

(a) Transmission efficiency for unlicensed spectrum.

(b) Low latency.

(c) Beams scheduled at the beginning of each slot.

(d) None of the above.

3. Which of the following is/are true about beamforming?
   (a) The combination of analog and digital beamforming is supported by NR.
   (b) Analog beamforming gives unlimited degrees of freedom.
   (c) In digital beamforming every antenna has its own digital to analog converter and amplifier.
   (d) Only digital beamforming is supported by NR.

4. Which of the following is/are true about 5G bandwidth?
   (a) carrier bandwidth in NR up to 400MHz.
   (b) Up to 16 component carriers
   (c) The subcarrier spacing is up to 120KHz
   (d) A UE can't support less than the carrier bandwidth

5. Which of the following choice(s) is/are NR characteristics?
   (a) Ultra-lean design
   (b) Backward compatibility
   (c) LTE and NR cannot coexist together
   (d) Low latency

6. What is/are true about high-frequency spectrum in cities?
   (a) It is needed to satisfy the traffic demands and possibly future demands as well.
   (b) It improves the coverage area like buildings that lower frequencies couldn't penetrate in.
   (c) It is a replacement for the previous low-frequency operations
   (d) It is optimized when used in joint operations with lower frequencies.

7. Which of the following statements is/are incorrect?
   (a) In non-standalone NR, LTE handles initial access and mobility.
   (b) The first 5G release is NR Release 16.
   (c) In stand-alone NR, NR handles initial access and mobility.
   (d) One of the NR characteristics is that it provides multi-antenna support.

8. Which of the following is(are) true regarding bandwidth in 5G NR?
   (a) A UE needs to support 400 MHz carrier bandwith to work properly.
   (b) Bandwidth adaptation is useful to reserve power.
   (c) Switch of active bandwidth parts is slow.

(d) None of the above.

9. Which of the following is/are true about multi-antenna transmission in NR?

(a) Analogue beamforming can transmit multiple directions at the same time.

(b) In higher frequency such as millimeter waves, there could be up to several hundreds antenna elements.

(c) Digital beamforming requires own DAC and amplifier for each antenna element, hence making the implementation more challenging than analogue beamforming.

(d) Both analogue beamforming and digital beamforming (as well as hybrid) are supported by NR.

10. Which of the following is/are examples of NR characteristics?

(a) High latency

(b) Multi-antenna support

(c) Forward compability

(d) Narrow spectrum range

11. What/Which of the following is true about analog and digital beamforming?

(a) Analog beamforming has limited degrees of freedom.

(b) Digital beamforming has highest degree of freedom.

(c) Both analog and digital beamforming are supported by NR.

(d) Digital beamforming is easy to implement at high frequency.

12. Which of the following is/are correct about analog and digital beamforming?

(a) From the practical perspective, it is more preferable to use digital beamforming than analog beamforming due to the simplicity of its implementation.

(b) Digital beamforming allows to transmit multiple data streams with a separate directivity at the same time.

(c) Hybrid analog and digital beamforming is not supported by NR.

(d) Analog beamforming refers to the formation of a single beam in a particular angular direction.

13. Which of the following is/are a major cost for upgrading to a 5G network?

(a) Building Base Station

(b) Electricity

(c) Adapting network slicing by hosting virtual machines

(d) Running 4G system in parallel

14. Which of the following statements is/are true about 5G NR?

(a) The use of network slicing provides a more flexible way of running networks.

(b) The reason that the non-standalone NR was released early was to fulfill the need of data.

(c) TDD is often used for the whole range of 5G spectrum.

(d) Compared to LTE, NR uses a higher frequency spectrum.

15. Regarding NR technologies and its possibilities, what/which of the following is/are true?

(a) Beamforming scheme must be decided beforehand since analog and digital beamforming cannot be both be supported by NR.

(b) By virtually dividing a physical network into network slices, different slices can serve different users' requirements.

(c) NR and LTE systems can coexist by sharing the spectrum.

(d) Increased connectivity applied in industry may be a driving force both for 5G and for new technologies and applications.

16. Which of the following description is/are correct about the challenges of mm-wave?

(a) Due to the higher frequency, there is propagation challenge for wave from outdoor-to-indoor.

(b) Signal with larger wavelength has lower propagation attenuation in the environment compared with that of smaller wavelength.

(c) The implementation challenges include: efficiency, deterministic range, output power...

(d) Above 6 GHz, there is extra limitation of transmitted power.